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STUDIES IN THE

BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF
ROBERT BROWN.

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BY H. N. DIXON, M.A., F.L.S.

PARTS I—VI.

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BY H. N. DIXON, M.A., F.L.S.

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Plates I–IV.

INTRODUCTION.

All bryologists who in recent years have had much to do with the mosses of New Zealand have soon found themselves in deep waters, owing to the description by various authors (particularly C. Muller, W. Colenso, and Robert Brown, of Christchurch) of a large number of species of most of which it was impossible to obtain authentic specimens, while the bulk were either not figured at all or on such a scale as to afford little help to their identity. This has been especially the case with the species described in various papers in the "Transactions of the New Zealand Institute" by the late R. Brown, of Christchurch. As an instance of the fertility of his labours, it may be recalled that in two succeeding papers (Trans. N.Z. Inst., vol. 27, pp. 409, 422) he described twenty-six new species of *Grimmia* and forty of *Orthotrichum*. The impossibility of collating these with previously described plants has led to a general neglect of Brown's species (*cf.* Paris in Rev. Bry., 1900, p. 49, "Musci Novo-Zelandici Browniani"; and Brotherus in Engler and Prantl, Pflanzenfamilien, Musci, *passim*). Under the circumstances this was inevitable, but it is none the less unsatisfactory. Not only does such a treatment do an injustice to Brown's work—an injustice for which he was no doubt himself chiefly responsible—but it has put a great barrier in the way of the progress of New Zealand bryology—a barrier likely to remain long insurmountable unless something can be done to lessen or remove it. To give a slight instance in point: I have had a considerable number of specimens of *Orthotricha* sent me by Mr. W. Gray, of Mauriceville, some of them undoubtedly species undescribed in the "Handbook of the New Zealand Flora" or in any work of European origin; but it is quite impossible to determine whether any or all of them are described in the above-cited paper of Brown's, in the absence of specimens for comparison. One is brought at once to a deadlock, and the same thing is likely to occur in connection with any of the groups dealt with by the same writer. To some extent this applies also to the species created by C. Müller and Colenso, but specimens of a considerable number at least of these have been distributed and are more or less available, while their descriptions are, for the most part, fuller and more discriminating.

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* Communicated by Dr. L. Cockayne, F.R.S. Read before the Philosophical Institute of Canterbury, 6th November, 1912.

In these circumstances, it seemed desirable, if possible, to effect a revision of Brown's plants, which existed, if anywhere, in his own herbarium of mosses preserved in the Canterbury Museum at Christchurch, and the herbarium has been entrusted to me for the purpose.

Unfortunately, at the very outset a great disappointment awaited me, for on examining the herbarium I found that not a single specimen of the *Orthotricha* referred to above was present, and few, if any, of the *Grimmiae*. Other genera, such as *Andreaea* and *Bryum* were well represented, but such absences as the above point to great gaps in the collection, which most unhappily it seems impossible to rectify. It is rather curious, too, that in such a genus as *Andreaea*, while the greater number of Brown's new species are present, they are represented in most cases by a single specimen marked "co-type." In what sense exactly he uses this term it is difficult to say; it does not refer to an alternative gathering of the moss, for in many cases the label shows the specimen to be part of the original gathering. In the case of the *Orthotricha* and *Grimmiae* there is reason to believe that the specimens upon which he based his species were small in quantity, and probably scarcely capable of division. It is possible, though scarcely likely, that these and all his "types" were kept separately, and that the herbarium as now in the Museum represents only such plants as were not species of his own describing, together with duplicate ("co-type") specimens of such as would bear division. It is more probable that he attributed no value in particular to "type" specimens, and was at no pains to preserve them, considering that when once described and figured their work had been accomplished and their purpose served. Whatever the explanation, I am assured that there is no hope of the appearance of any further specimens, and am compelled to make the most of whatever material is available in the collection sent.

The personality of the late R. Brown must have been a striking one. Dr. L. Cockayne, who knew him in his collecting days, writes of him, "He was the most enthusiastic naturalist I ever met—a man of but little education, intensely modest in many ways, and yet self-opinionated to no small degree. He was about seventy years of age when he first commenced to write. . . . His microscope was old and in bad repair; his drawing apparatus was self-made; he possessed hardly a book beyond the Handbook and some ancient botanical text-books. In the field no discomfort, no toil, was too great. He would sleep in the open, perhaps without food, carry heavy burdens for incredible distances, be wet through for weeks at a time—and all for his love of natural history. I have seen him after a long day's tramp, and when eighty years of age, walk barefoot on a stony river-bed in search of wood for the fire. He was a shoemaker by trade, but for many years did no work—not because he had much of this world's goods, for he had very little. His one love was nature in all its forms, and, get him away from mosses, his conversation was clever and his views on many points brilliant."

That the botanical work of a man of such enthusiasm, so true a lover of nature's works, so indefatigable and unsparing of himself in their pursuit, should stand in danger of being lost to science would be deplorable. It is in the hope of rescuing some parts at least from oblivion that I have undertaken these papers.

The specimens in the herbarium, though too often scanty and even fragmentary, are usually well prepared and in good condition, but the labelling shows much want of scientific method. The locality is often not given, particulars of habitat rarely, and date scarcely ever, while even the name is frequently misspelt—even in the case of his own new species the herbarium name not corresponding with the name as published in his papers.

One thing strikes a reviewer of Brown's work as curious and in some degree unexpected and inconsistent. He avowedly published his new species without reference to those previously described, on the ground that the specimens on which the latter were founded were for the most part in Europe and unavailable to New Zealand students, while the accessible descriptions and figures were in many cases insufficient to identify them, and in such cases he had no choice but to describe his plants as new. This may be common-sense, but it is not science; though it is difficult to see what else, circumstanced as he was, he could well have done short of giving up the study; and it would have been not only a pardonable but even a laudable course if he had taken it in such a way as to avoid the errors for which he criticized the previous authors. He might even in his isolated position have greatly assisted future workers had he given us lucid descriptions accompanied by accurate and well-selected illustrations, together with ample material of the plants described, for future study, at the same time pointing out to which of the previously described plants each of his new species appeared to be most nearly allied, with notes on the apparent differences, and his reasons for considering it to be new. Instead of this, his descriptions are for the most part bald; he gives in general no explanatory notes or comments or comparisons whatever; and his illustrations, while, I believe, carefully done and accurate as regards leaf outline, give no idea of the general appearance of the plant, and, as a rule, no detail at all, while they are usually on too small a scale to be of any practical value. This applies particularly to his drawings of peristomes, while of areolation he takes practically no account. It may quite possibly have been due to want of the necessary equipment, but, whatever the cause, it annuls the value of the description in nearly every case where there are no specimens in his herbarium to elucidate them.

It is certainly surprising that, recognizing as he did the inadequacy of many of the figures in such works as the "Flora Antarctica" to give the means of identifying the species, he should have been satisfied with what seem to us the perfunctory repetitions of similar drawings on plate after plate which most of his figures exhibit. Probably his intense delight in the mosses, and his keen vision, joined to a lack of scientific training, enabled him to see among plants differences which actually existed but which often did not constitute clearly definable characters, and therefore failed to be reproduced when he came to putting them into words or delineating them for illustration. So a phanerogamic botanist with a keen eye for fine colour distinctions is apt to describe colour varieties which are very poorly borne out by his herbarium specimens themselves, a few months after laying in!

In the present papers, without attempting (except in certain cases) to give a complete revision of the New Zealand species in each group, I shall make it my aim to bring together, as far as known to me, the species hitherto recorded from New Zealand, hoping that this may provide material for some author in the near future for what is so much to be desired—a complete work, brought up to date, on the bryology of one of the most interesting phytogeographical regions of the world.

The proper description of Brown as author of new species has given rise to some question. In addition to Robert Brown (*princeps botanicorum*) there have been others of the name who have described new species of plants: of these, Rob. Brown of Campster is usually known as "R. Br. Campst." For the present author, R. Brown of Christchurch, Dr. B. Daydon Jackson has proposed the cognomen "R. Br. ter.," and this is the method of citation—already employed in the "Index Kewensis"—which I propose to adopt.

I. DICRANACEAE.

A REVISION OF THE NEW ZEALAND SPECIES OF DICRANOLOMA.

DICRANOLOMA Renauld in Rev. Bryol., 1901, p. 85 (Prodr. fl. bryol. de Madagascar, &c., 1897, as subgenus).

I have followed Renauld's latest views in treating this group as a separate genus, although, as that author points out ("Essai sur les Leucoloma," p. 20), it is extremely difficult to indicate clearly any characters separating certain of the species from *Dicranum*, the border of narrow hyaline cells being at times wanting, and often nearly so. I do not, however, feel able to follow Renauld in his division of the genus into two groups, or subgenera, as follows ("Essai sur les Leucoloma," p. 21):—

"Subg. I. SCOPARIOIDIUM.—Capsule à col lisse ou à peine renflé, arquée ou plus rarement dressée-symétrique.

"Subg. II. ONCOPHOROIDIUM.—Capsule toujours arquée à col muni d'une apophyse saillante."

He proceeds to say that there are certain species which must remain somewhat indecisive, as the neck of the capsule possesses an indistinct struma. I find this to be the case so markedly among the New Zealand species that this division would be of little practical value even among fertile plants, while, too, it has the very unsatisfactory result of separating species very closely allied, and at the same time reuniting others which are obviously far wider apart.

I have reason to believe, moreover, that one factor in relation to the development of the struma has been somewhat insufficiently appreciated—viz., that in species showing normally a struma it is frequently almost or quite obliterated in capsules which have not thoroughly matured before drying. This maturing has far from always taken place even with capsules gathered when *apparently* ripe, which may even lose their lids in process of drying, and show a peristome quite complete. In such apparently ripe capsules the exothecium tissue has not become completely matured, and in the process of desiccation it undergoes considerable shrinkage, especially in the neighbourhood of the collum, in which case the struma is frequently rendered indistinct or obsolete, and the capsule becomes narrower and elongate. The best evidence of this is to be found by comparing the capsules ripened under such conditions with those perfectly matured. I have over and over again examined tufts of various species in which the just-ripened and, of course, most conspicuous capsules—some at least deoperculate and apparently fully matured—showed a tapering base with very little trace of a struma, when capsules of a previous year exhibited a distinct struma and by their unshrunken condition and texture at once revealed the fact that the later ones had dried before the outer walls had attained the firmness of complete maturity.

This has probably been the cause of confusion in the past. Thus *D. subpungens* (Hampe) is described by the author as "*D. pungenti* simile, theca breviore strumosa satis differt," implying that the specimens he had seen of *D. pungens* were estrumose; the type specimen of the latter, however, shows clearly that in well-ripened capsules the struma is distinctly developed, and the capsule shorter and wider in form than in less perfectly matured specimens. Most, in fact, of the New Zealand species of the genus show some trace of struma, although it is much more strongly developed in some species than in others.

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Islands, and usually known in its robust and dense erect-leaved form, should be recognized in some of the slender forms, with leaves more or less distant and often strongly falcate, which occurred in various parts of New Zealand and Australasia—more especially by New Zealand botanists who had little or no access to the collections where the types of these and other antarctic plants were preserved.

This, however, is undoubtedly the case, and not only with *D. setosum*, but with others of the genus, and accounts for a considerable proportion of the synonymy which has grown up. As a notable example of this, it may be mentioned that what may be looked upon as the type specimen of *Dicranum setosum* H. f. & W. (Campbell Islands, No. 26*b*, in Herb. Hooker.) consists of two distinct forms, one a slender form which was at one time separated by the authors as var. *attenuatum*.

A further difficulty in the study of the group arises from the excessive mixture that occurs in some of our herbaria. Examples of this will be apparent further on. A notable instance has taken place with *D. leucolomoides*: Mitten received what purported to be part of the type gathering, but was entirely *D. fasciatum*, a totally different moss: this led to his placing *D. leucolomoides* under the synonymy of *D. fasciatum*.

I have endeavoured to elucidate the characters of this difficult group by figures of those species which are here published for the first time, as well as of some which have not hitherto been figured. I have for the most part relied on the character of the subula and the areolation of the upper part of the leaf. In all the species figured the subula will be found depicted on the same scale throughout (× 20), and the areolation (also on a uniform scale, × 200) taken at a portion of the leaf approximately answering to the basal part of the subula figured. I have attempted to give a comparative idea of the width of the nerve in the latter figures by showing *half* the width of the nerve in all cases where the whole nerve is not indicated.

It need scarcely be pointed out, however, that too rigid an interpretation must not be given either to the figures or to the characters given in the key. The general form of the areolation and the degree and character of the armature may be indicated in a single figure, but allowance must always be made for the variation which these characters undergo. This is especially marked in the thickening of the cell-walls and the degree of porosity exhibited, which may vary considerably in the same species. Thus the type specimen of *D. Billardieri*, a species specially characterized by the porosity of the cell-walls throughout the leaf, has the porosity so obscured and indistinct in many leaves that it might easily be overlooked altogether.

I have to acknowledge gratefully the assistance I have received from the authorities of the National Herbaria at Kew and South Kensington, as well as of New York, for material used in this study; and especially from the Director of the National Museum at Berlin for the loan of the types, from C. Müller's herbarium, of the various species of that author described and referred to. It should perhaps be mentioned that in the case of C. Müller's undescribed species—as for instance, those enumerated by him in the "Genera Muscorum Frondosorum"—no descriptions or notes are attached to the type specimens in his herbarium, and I have drawn up the descriptions entirely from my own study of the plants.

I should also wish to express my thanks to Dr. Leonard Cockayne for assistance in several ways, especially for kindly undertaking to see this paper through the press; and to Mr. Edgar R. Waite, Curator of the Canterbury Museum, in entrusting me with the loan of R. Brown's herbarium.

KEY TO THE SPECIES.

1. Cells of subula minute, rounded, incrassate, frequently isodiametric, 6–8 μ × 4–6 μ in diameter 2
Cells of subula elongate, or, if short, larger, angular, and not much incrassate .. 3

2. Leaves longly setaceous and flexuose, sharply serrate above; nerve stout. 1. *Menziesii.*
Leaves short, shortly pointed, not flexuose, entire or denticulate at point only; nerve broad but very thin below .. .. 2. *diaphanoneuron.*

3. Juxtacostal cells of subula short and markedly different from the elongate, linear marginal cells of the sharply spinulose border; leaves with a deep plica on either side of the nerve below .. .. .. 3. *dicarpum.*
Juxtacostal cells of subula scarcely shorter than marginal cells 4

4. Cells of subula markedly short, 3 × 1 or often less, oval, or oblong with rounded angles 5
Cells of subula rarely less than 4 × 1, usually longer, linear 6

5. Leaves subtubular above, closely serrulate towards apex; nerve closely and finely spinulose at back .. .. 11. *cylindropyxis.*
Subula scarcely concave, sharply and strongly serrate, nerve at back distantly serrate .. .. 4. *platycaulon.*

6. Nerve in lamina broad or moderately so, at least 60 μ in widest part, usually much more, often ill defined 7
Nerve in lamina very narrow, 50 μ or less, often much less 13
Nerve moderately wide, about 60 μ, strong and well defined, especially in subula, all upper part in 2 rows strongly spinose-dentate at back; cells elongate and porose to apex .. .. .. 12. *plurisetum.*

7. Leaves 0·75 mm. wide or less below 8
Leaves 1 mm. or more wide below 9

8. Moderately robust, leaves rather close .. .. 10. *pungens.*
Slender, yellowish, leaves lax .. .. 9. *leucolomoides.*

9. Nerve becoming wider above and very ill defined in subula .. 6. *setosum.*
Nerve about equal throughout or narrower above, usually well defined in the subula 10

10. Leaves about 1 cm. long, often less .. .. 10. *pungens.*
Robust plants, leaves 1·25–1·5 cm. long 11

11. Leaves without a distinct pale border below* .. .. .. 5. *robustum.*
Leaves distinctly hyaline-bordered 12

12. Cells of subula very incrassate, margins finely and closely denticulate 8. *chrysodrepaneum.*
Upper cells slightly wider, with thin walls, subula more distantly serrate, nerve weakened towards base .. .. 7. *grossialare.*

13. Nerve in lamina thick and opaque (*Heteroneuron*) .. .. 10. *pungens.*
Nerve faint, translucent, often indistinct below (*Leptoneuron*) 14

14. Leaves entire, or denticulate only at apex 15
Subula more or less sharply toothed 16

15. Leaves very dense, 0·75–1 cm. long, subula fine .. .. 16. *integerrimum.*
Leaves rather lax, less than 0·75 cm. long, subula rather wide 15. *Pungentella.*

16. Leaves with a broad, very distinct hyaline border; perichaetial bracts reaching to and often overtopping the capsule; cells thin-walled 14. *fasciatum.*
Leaves with very narrow or indistinct border; seta much longer than perichaetium; cells more or less incrassate .. .. .. 13. *Billardieri.*

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* Since the above was in type I have received further material indicating that the presence or absence of a border is not always a safe guide in the case of *D. robustum*, and further rendering it very doubtful if *D. chrysodrepaneum* is really separable from that species.

1. **Dicranoloma Menziesii** (H. f. & W.) Par., Index, ed. ii, p. 28 (1904). [Plate IV, fig. 16.]

Syn. *Dicranum Menziesii* H. f. & W. in Lond. Journ. of Bot., 1844, p. 541. *Leucoloma Menziesii* Broth. in Engler and Prantl, Musci, p. 322 (1901). *Dicranum brachypelma* C. M. in Bot. Zeit., 1851, p. 550 [*non D. brachypelma* C. M., Syn., ii, 595 (1851)]. *Dicranum kaïparense* Par., Ind., p. 356 (1895). *Dicranoloma kaïparense* Par., Ind., ed. ii, p. 27 (1904). *Dicranum suberectum* Hampe in Linn., 1859, p. 629. *Dicranoloma suberectum* Par., Ind., ed. ii, p. 30 (1904). *Dicranum oedithecium* C. M. in Hedw., 1897, p. 357 (*fide* Brotherus, *op. cit.*). *Dicranoloma oedithecium* Par., *op. cit.* *Dicranum trichophyllum* Hampe in Linn., 1871–73, p. 515 (*fide* Brotherus, *op. cit.*). *Dicranoloma trichophyllum* Par., *op. cit.* *Dicranum Kroneanum* C. M. in Hedw., 1897, p. 358 (*fide* Brotherus, *op. cit.*). *Dicranoloma Kroneanum* Par., *op. cit.* *Dicranum fulvum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 462 (1896) [*non D. fulvum* Hook., Musc. exot., 1820]. *Dicranoloma fulvum* Par., *op. cit.* *Dicranum Brownii* Par., Ind., Suppl., p. 121 (1900).

Var. **rigidum** (H. f. & W.) Par.

Syn. *Dicranum Menziesii* var. *rigidum* H. f. & W., Flora of N.Z., vol. 2, p. 170 (1855).

D. Menziesii is distributed throughout the subantarctic region, being recorded from Chile, Auckland Islands, Norfolk Island, Chatham Islands, New Zealand, Tasmania, and Australia.

It is quite distinct from all its congeners (except *D. diaphanoneuron*) in these regions, not only in the areolation, but in the form of the leaves, their expanded part being far shorter in proportion to the subula than in nearly all the remaining species, while the fruiting characters also, the short perichaetium and seta, and the often very short striated capsule combine to give the plant a very different appearance from most of the species.

I refer to var. *rigidum* (H. f. & W.) a short form with more erect, brittle leaves, which I have from Tapanui, Otago (*leg.* Petrie), from near Auckland, and from Mount Cook district (*leg.* Murray, Nos. 7, 129A). Intermediate forms occur between it and the type.

Some of the synonymy of *D. Menziesii* deserves notice. C. Müller, in the supplementary pages of the Synopsis described a *Dicranum brachypelma* from Java, and during the same year, in Bot. Zeitung, a New Zealand species under the same name. Paris is in error (Index, ed. ii) in citing New Zealand under the distribution of the former. For the latter he substitutes the name *D. kaiparense*, but unnecessarily, since C. Müller had already indicated his acceptance of Mitten's view that the *D. brachypelma* of the Bot. Zeit. was only *D. Menziesii* (*cf.* Gen. Musc. Frond., p. 288, 1901).

There exists in R. Brown's herbarium, unfortunately, no specimen of his *D. fulvum*, but from the description as well as the figures there can be no doubt that it is a form of *D. Menziesii*. Indeed, he gives no characters whatever that would separate it, with the single exception of the very short, turgid capsule, by which no doubt he was led astray. I have in my herbarium specimens of *D. Menziesii* from Mitten's herbarium with capsules almost identical with the figure given by Brown, and the type specimen of C. Müller's *D. brachypelma* shows almost exactly the same form of capsule.

Dicranoloma setosum (H. f. & W.). New Zealand, *leg.* Sowerby, in Herb. Mitten., is *D. Menziesii*.

2. **Dicranoloma diaphanoneuron** (Hampe) Par., Ind., ed. ii. p. 26 (1904). [Plate III. fig. 9.]

Syn. *Dicranum diaphanoneuron* Hampe in Linn., 1869–70, p. 515.
„ *Leucoloma diaphanoneuron* Broth. in Engler and Prantl, Musci, p. 322 (1901).

I have seen no New Zealand specimens of this, but it is recorded by Brotherus from "Victoria, Tasmania, and New Zealand." It is an interesting plant, combining with a very close relationship to *D. Menziesii* a totally different aspect from most forms of that species, and also an entirely different leaf-outline. The type specimen, which I have examined in Hampe's herbarium, as well as a part of the original gathering for which I am indebted to Dr. Brotherus, show a short, straight leaf, scarcely longer in the subula than in the expanded part, and with a few denticulations at most towards the apex.

Hampe's description of the leaves as "subenervia" is rather misleading, especially as he emphasizes it by his note, "ab omnibus generis abnorme, loco nervo, striae paucae rectae ad folii basim adsunt." For the nerve is constantly distinct, and, indeed, well marked, in the upper part of the leaf, and while towards the base it becomes, it is true, very faint and inconspicuous, this is entirely due to its thinness and translucent texture, not by any means to a want of development. It is, indeed, a rather surprising fact that this nerve, so inconspicuous as to be often almost invisible, belongs to the type *Toromerum*, the most highly developed, histologically, of all the forms of nerve in the genus. The deuter are small, 10–14 in number, and the remaining cells, epidermal as well as hypodermal, all more or less stereid and subsimilar.

I have not seen the fruit, but judging from Hampe's description ("seta subuncialis," &c.) it exhibits some marked differences from that of *D. Menziesii*.

3. **Dicranoloma dicarpum** (Hornsch.) Par., Ind., ed. ii. p. 26 (1904). [Plate III. fig. 8.]

Syn. *Dicranum dicarpum* Hornsch. e Schwaegr., Suppl. iii, vol. 2, t. 251 (1829). *Leucoloma dicarpum* Broth. in Engler and Prantl, Musci, p. 322 (1901). *Dicranum polysetum* Hampe in Linn., 1859, p. 629. *Dicranoloma polysetum* Par., *op. cit.* *Leucoloma polysetum* Broth., *op. cit.*

This widely distributed species in the Australasian region is clearly marked by the deeply plicate leaves, together with the character of its areolation (*cf.* figs. 8*b*, 8*c*). In this latter respect *D. plurisetum* is perhaps the only species which might be confused with it, but there the juxtacostal cells of the subula are much longer than in the present species; the sharply spinose dentation of the leaves in *D. dicarpum* extends much lower in the leaf than in *D. plurisetum*, while the latter has a much broader and more distinct hyaline border in the lower part of the leaf, which is not biplicate as in *D. dicarpum*.

I am fully in agreement with Mitten's expressed opinion that *D. polysetum* (Hampe) is not specifically distinct from *D. dicarpum*. I have been tempted to retain it as a variety, treating the more short-leaved form with usually two capsules in each perichaetium and on short setae as the type, the robust plant with long leaves, longer setae, and several capsules (3–8) in a perichaetium as the variety; but comparison of a number of specimens shows so many intermediate forms, and so little correlation between number of capsules and length of setae, that I think it is quite impracticable to separate them.

The var. *spinosum* H. f. & W. (described in the "Handbook of the New Zealand Flora" as "a large variety with numerous (3–8) longer setae") is clearly the same thing as *D. polysetum*.

Dicranoloma Whiteleggei (C. M.) Par., from New South Wales, is considered by Renauld to be a regional race of *D. dicarpum*. In vegetative characters and structure it is identical, but differs in the erect, symmetrical non-strumose capsule. In the absence of intermediate states these characters can hardly be neglected, but if the specific rank be admitted the name must certainly be changed. I have examined the type of *Dicranum argutum* in Hampe's herbarium, from New South Wales, and find it absolutely identical with *D. dicarpum* in its vegetative characters, and, as the single capsule known is "elliptico-cylindrica, recta," it is certainly identical with *D. Whiteleggei*. Hampe's species was published in Linnaea for 1869–70, and has, therefore, priority over *Leucoloma Whiteleggei* C. M. (1897).

Dicranum chlorocladum C. M. in Hedw., 1897, p. 362, must also fall into the synonymy of *D. argutum*. The type in C. Müller's herbarium exhibits no difference from *D. Whiteleggei*. This is the more surprising as the two were described in the same paper. Under *D. chlorocladum* C. Müller makes no comparison with any other species, but under *Dicranum* (*Leucoloma, Oncophoroloma*) *Whiteleggei* he writes, "*Orthodicrano chlorocladо* ex habitu similis, sed haecce species ad Leucolomatis tribum non pertinens"—*i.e.*, *D. chlorocladum* differs from *D. Whiteleggei* in the fact that the former belongs to *Dicranum* and the latter to *Leucoloma!* He gives, however, absolutely no reasons in support of the statement that *D. chlorocladum* belongs to *Dicranum* and *D. Whiteleggei* to *Leucoloma*. Whatever the reasoning might be worth, it is invalidated by the fact that, as Renauld has shown, *D. Whiteleggei*, like *D. dicarpum*, is *not* a species of *Leucoloma* at all (*sensu stricto*), but a *Dicranoloma*, and of precisely the same position, therefore, as *D. chlorocladum*. I have been unable to trace *D. Whiteleggei* in the Gen. Musc. Frondos. In that work "*Leucoloma, Oncophoroloma*," under which *D. Whiteleggei* is placed in Hedwigia, is diagnosed as having the capsule strumose and somewhat curved, while the capsule of *D. Whiteleggei* is described by the author as "erecta, cylindrica."

The synonymy will therefore run as follows:—

DICRANOLOMA ARGUTUM (Hampe) Par., Ind., ed. ii, p. 24 (1904).

Syn. *Dicranum argutum* Hampe in Linn., 1869–70, p. 516. *Leucoloma argutum* Broth. in Engler and Prantl, Musci, p. 322 (1901). *Dicranum Whiteleggei* C. M. in Hedw., 1897, p. 360. *Dicranoloma Whiteleggei* Par., *op. cit.* *Leucoloma Whiteleggei* Par., Ind., p. 231 (1895). *Dicranum chlorocladum* C. M. in Hedw., 1897, p. 362. *Dicranoloma chlorocladum* Par., Ind., ed. ii, 25 (1904). *Leucoloma chlorocladum* Broth., *op. cit.*

D. argutum has not, I believe, been found in New Zealand.

4. Dicranoloma platycaulon (C. M.) sp. nov. [Plate III, fig. 10.]

Syn. *Dicranum platycaulon* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*).

Perrobustum. Caulis 6–8 cm. altus, *densissime foliosus*, frondem subcompressam, magnam, 1 cm. latam instruens. Folia *magna*, regulariter falcata, sicca *subundulata* minime mutata, nec crispata; ad 1 cm. longa, e basi perlata (1·5–2 mm.) sensim in subulam latiusculam *haud setaceam carinatam nec tubulosam* angustata, marginibus per totam subulae longitudinem *argute grossiuscule serratis*. Costa in media lamina 100–120 μ lata, in subula perdistincta, lata, dorso *valde prominens*, irregulariter distanter spinoso-dentata, breviter excurrens. Cellulae alares magnae, auriculas dilatatas, quarum unam majorem ad costam paene attingentem, alteram multo minorem, a costa cellulis multis angustissimis interjectis sejunctam, formantes.

Lamina folii inferne *limbo hyalino sat distincto* circumdata; areolatio inferior indistincta, valde conflata, e cellulis perincrassatis valde porosis instructa; cellulae subulae *perbreves, irregulares* (ellipticae, triangulares, &c.), 8–13 μ latae, parietibus *tenuibus vix porosis*, marginem versus saepius 1–2 seriebus angustioribus, incrassatis.

Perichaetium altiuscule exsertum, conspicuum, foliis internis perlatis, abrupte longiuscule tenui-aristatis. Setae *aggregatae* (ad 4), circa 1 cm. longae. Theca elongate elliptica, leniter curvata, strumulosa.

Hab.—Greymouth (R. Helms). Mount Cargill, 1888 (W. Bell): Taranaki (Jupp): Westland, 1872 (A. R. Bloxam): Lee Bay, Stewart Island, on logs in forest, October, 1908 (Cockayne, No. 8234): Mount Egmont, January, 1912 (W. Gray, Nos. 119, 124).

Type in Herb. C. Mull., in Mus. Bot. Berolin.*

The specimens coll. Jupp and Bloxam were sent me from Mitten's herbarium under the name of *D. angustinerve*.

This is a very fine and distinct species, resembling *D. robustum*, *D. dicarpum* (*forma polyseta*), &c., in habit, but amply and easily distinguished by the character of the subula and by the upper areolation, which is like none of the remaining New Zealand species, while in the form of the cells closely resembling the European *Dicranum Bergeri*. The wide and comparatively flat subula, not tubular nor convolute, is also a distinguishing character from most of the allied plants. The leaves have a less firm, more delicate texture than in most of the species. The cells of the expanded lamina vary considerably in length, but are always remarkable for their indistinctness, owing to the slight difference in colour and transparency between the cell-wall and the lumen.

The setae vary on a single tuft from 1 to 4 in a perichaetium.

5. Dicranoloma robustum (H. f. & W.) Par., Ind., ed. ii, p. 29 (1904). [Plate I, fig. 1.]

Syn. *Dicranum robustum* H. f. & W. in Lond. Journ. of Bot., 1844, p. 542, et Fl. Antarct., ii, 406, t. 152. *Leucoloma robustum* Broth. in Engler and Prantl, Musci, p. 323 (1901). *L. grandialare* Dus., Beitr. zur Bryol. Magellansländer, &c., in Arkiv. för Bot., bd. 4, No. 1, p. 26 (*fide* Cardot).

Distributed throughout the subantarctic region.

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* I ought, however, to mention that the above description and figures are drawn up from Bell's Mount Cargill plant, sent me by Dr. Brotherus. I have not seen the Greymouth specimen.

D. robustum appears to be less variable than some of the allied plants, though subject to some considerable degree of variation in point of size. In habit several other species resemble it, and this has given rise to frequent errors of identification. Thus "*D. robustum*, N.Z., *leg.* Colenso," in Herb. Mitten., belongs to *D. cylindropyxis*, while others of the larger and hitherto scarcely recognized species no doubt figure in herbaria as *D. robustum*. In all probability *D. robustum* is by no means a common New Zealand species.

It may, however, be recognized by the following characters: the robust habit, the broad nerve of *Toxoneuron* type only finely denticulate at back above, and the cells very narrow and elongate in the subula, will separate it from all but *D. setosum*, *D. grossialare*, and *D. chrysodrepaneum*. The last two have a distinct hyaline border to the lamina, which *D. robustum* usually at least lacks, while *D. chrysodrepaneum* has much shorter upper cells, especially the marginal row; *D. grossialare* has the upper cells elongate, but they are less incrassate, less porose, and more distinct, while the leaves are more crowded and more finely setaceous, and the seta very much shorter.

D. setosum is, as a rule, much less robust, with more crowded very finely setaceous leaves, which are smaller in the expanded base and with the nerve narrowed below but widened and very ill defined above. *D. pungens* differs principally in the narrower nerve, of *Heteroneuron* type.

6. **Dicranoloma setosum** (H. f. & W.) Par., Ind., ed. ii, p. 30 (1904). [Plate I, fig. 2.]

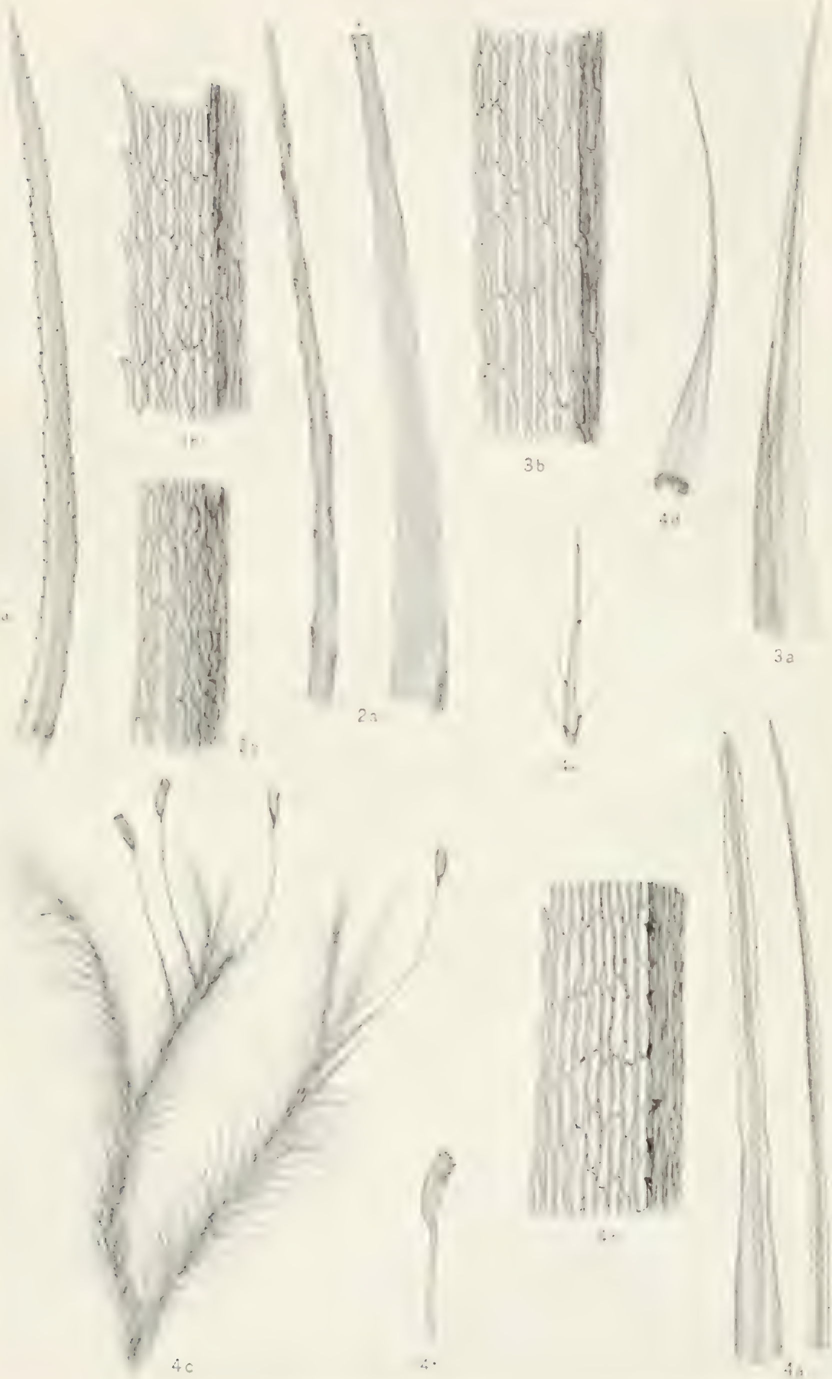
Syn. *Dicranum setosum* H. f. & W. in Lond. Journ. of Bot., 1844, p. 541, et Fl. Antarct., i, 129, t. 158. *Leucoloma setosum* Broth. in Engler and Prantl, Musci, p. 323 (1901). *Dicranum subpungens* Hampe in Linn., 1859, p. 629. *Dicranoloma subpungens* Par., *op. cit.*, p. 30. *Leucoloma subpungens* Broth., *op. cit.*, p. 323. *Dicranum calymperidium* Bailey, Synops. of Queensland Flora, 1884 (*fide* Watts and Whitelegge, Census Musc. Australens., p. 48). *D. calymperaceum* C. M. in Hedw., 1897, p. 357. *Dicranoloma calymperaceum* Par., *op. cit.*, p. 25. *Leucoloma calymperaceum* Broth., *op. cit.*, p. 323. *Dicranum subsetosum* C. M. in Hedw., 1897, p. 353. *Dicranoloma subsetosum* Par., *op. cit.*, p. 25. *Leucoloma subsetosum* Broth., *op. cit.*, p. 323.

Distributed throughout the subantarctic region.

I have found *D. setosum* a very perplexing subject, owing to the variability displayed, together with the lack of accurate distinguishing characters in the original descriptions. A comparison of the original diagnoses and figures of *D. setosum*, *D. pungens*, and *D. robustum* gives little aid as to the separating characters of each, and since Hooker's herbarium contains numerous specimens under each species, and no one or more are cited as types, it is far from easy to be certain as to the exact conception which the authors had as to their species. This is particularly the case as between *D. setosum* and *D. robustum*. That the difficulty is neither an imaginary nor a new one is clear from a study of the notes and descriptions in the "Handbook of the New Zealand Flora," as well as in R. Brown's "Notes on the Genus *Dicranum*" (Trans. N.Z. Inst., vol. 29, p. 451, 1897), where, following no doubt the former work, he separates *D. setosum* from most of the allied species as having the perichaetium short. This, however, is not borne out by the specimens in the Hookerian

1b

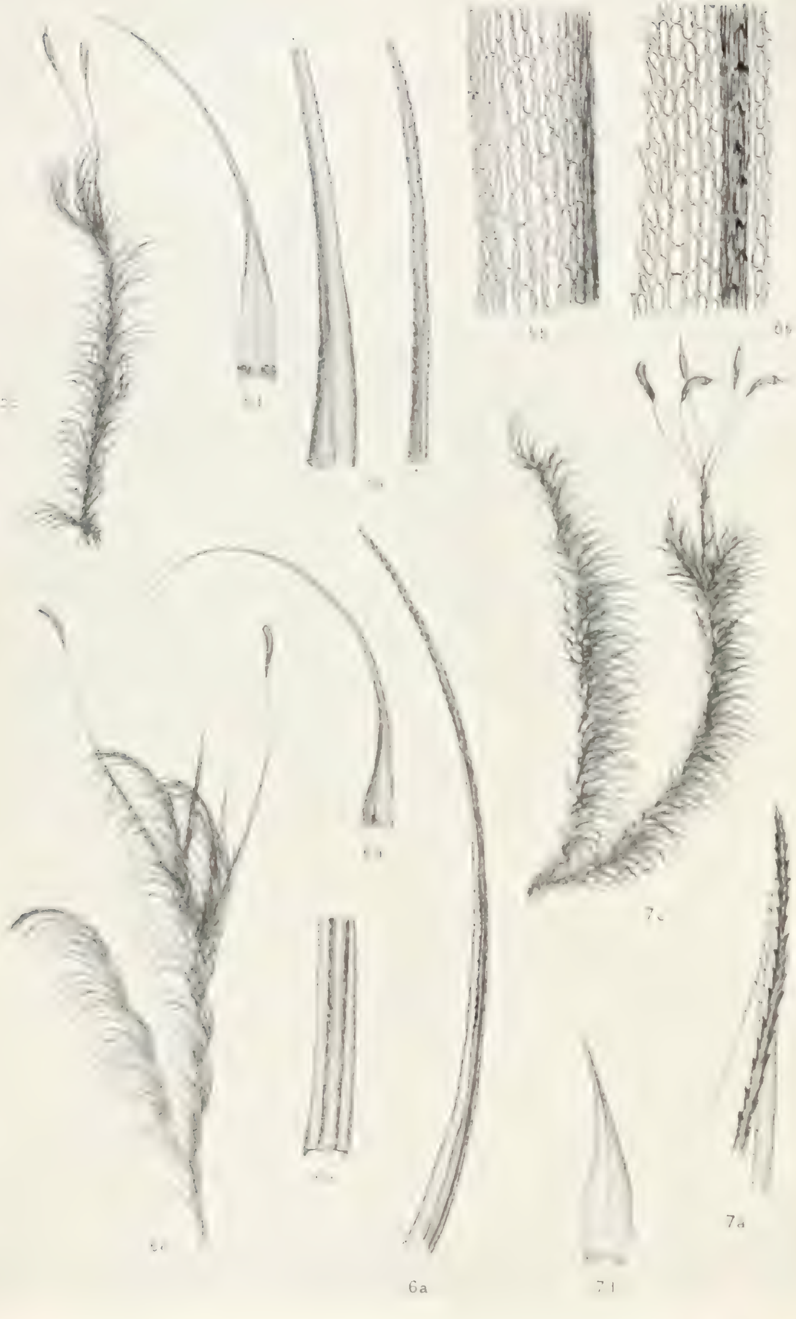
PLATE I.



1a
1b
3b
4d
2a
3a
2b
4c
4b

H. N. Dixon del.] [West, Newman, proc.

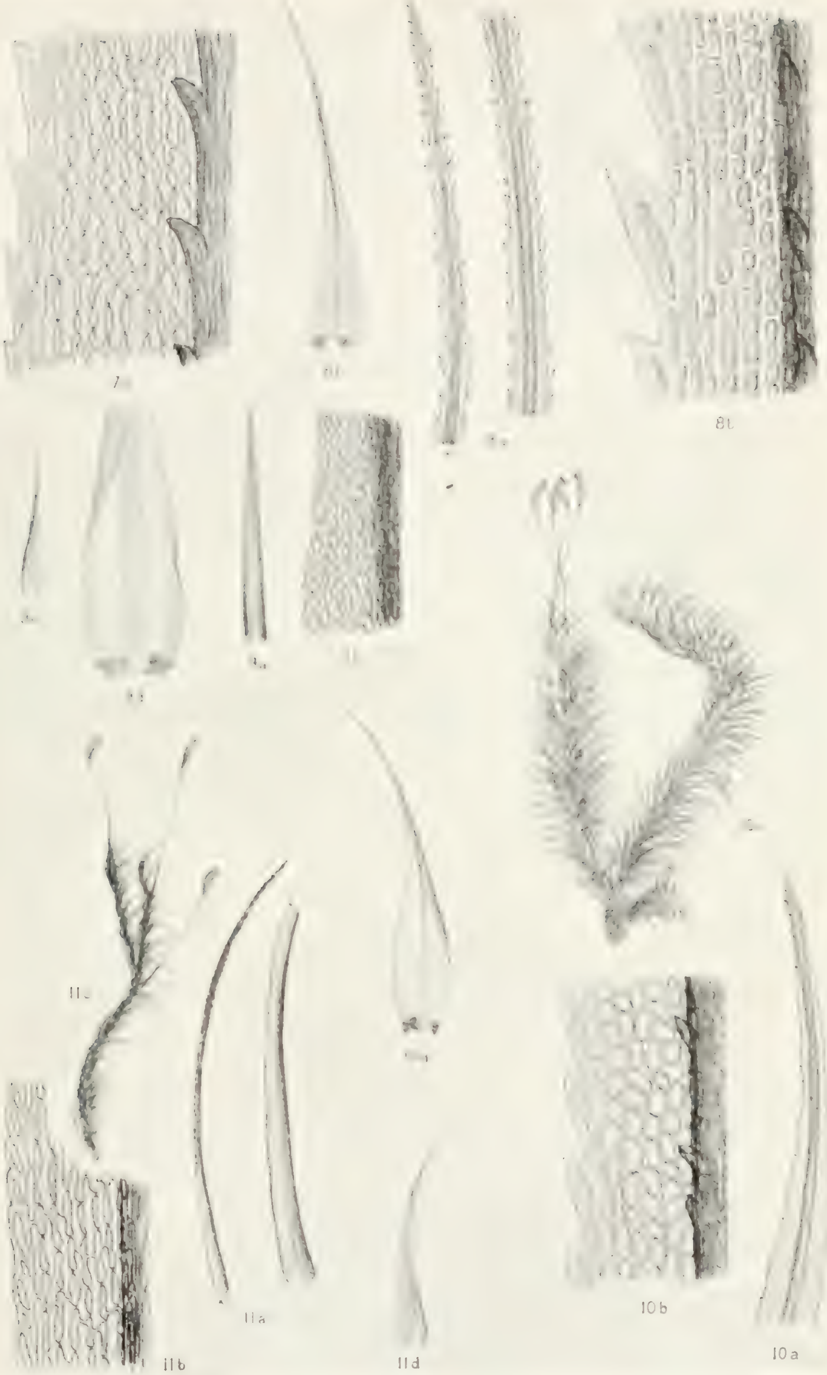
PLATE II.


6b
7c
6a
7b
7a

. N. Dixon del.] [West, Newman, proc.

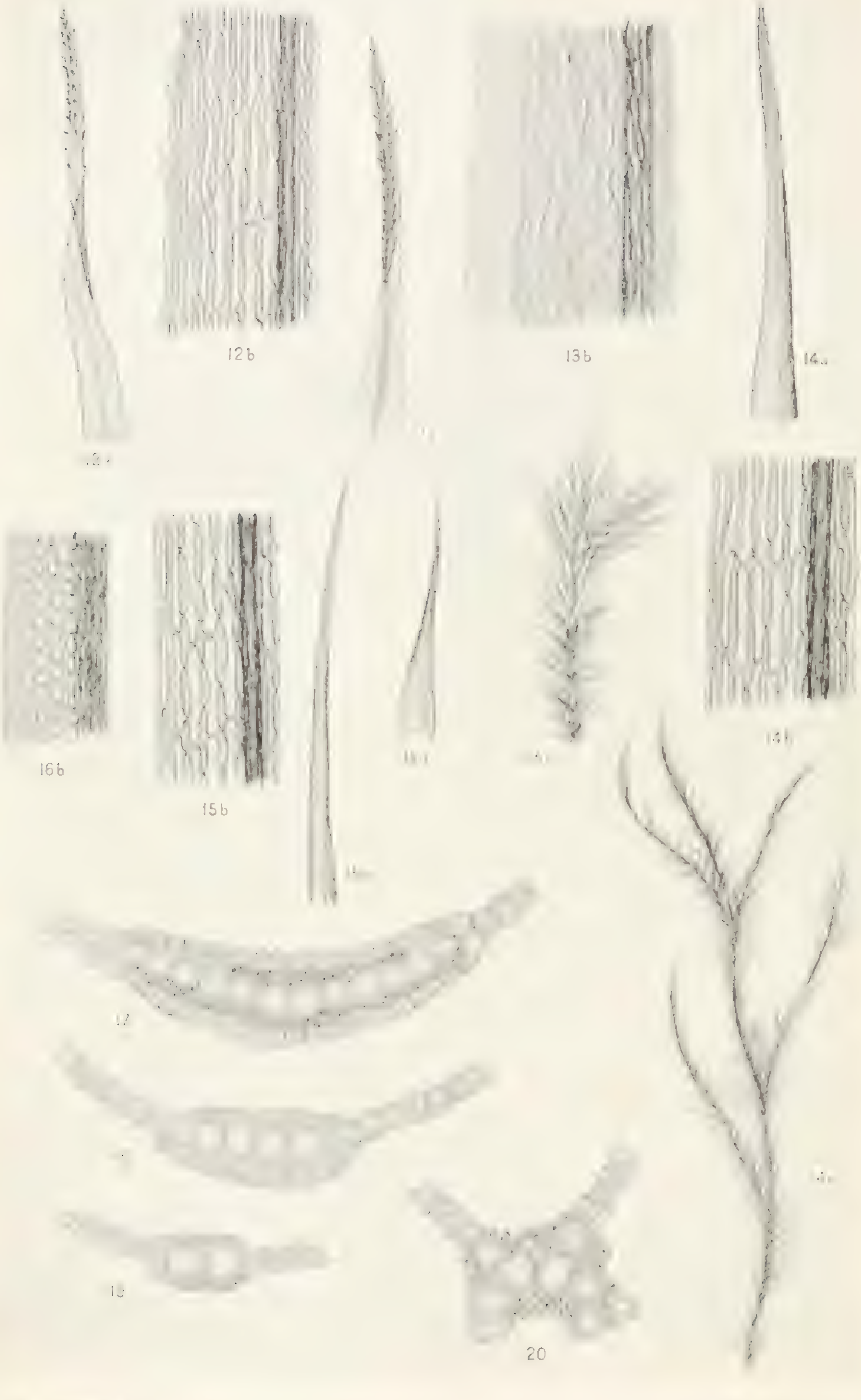
1b 2

PLATE III


7b
8b
11c
11a
11b
11d
10b
10a

H. N. Dixon del.] [*West, Newman, proc.*

PLATE IV


12b
13b
14a
16b
15b
14b
17
20

H. N. Dixon del.] [West, Newman, proc.

herbarium, nor by any others that I have seen: the perichaetia, when perfect, are similar to those of *D. Billardieri* and its allies, but with the inner bract aristate. In the specimens of Hooker's which must be looked upon as the types the perichaetia are usually 6–7 mm. in length, in W. 26 they attain 1 cm., the inner bracts suddenly contracted to a short arista, which in old specimens is nearly always broken off. In a specimen labelled "N.Z., Colenso, 152," the perichaetium is considerably over 1 cm. in length.

From a study of Hooker's plants I conclude that *D. setosum*, while variable in habit and size (the var. *attenuatum* H. f. & W. is scarcely more than a slender state associated at times with the typical form), as well as in some other characters, is best determined by its nerve, which, while varying in width in the lamina, invariably becomes wide and very ill defined in the subula, a character which separates it from nearly all, if not all, the allied plants—taken in conjunction with the character of the upper cells—except perhaps some forms of *D. robustum*. Roughly speaking, one might distinguish the three species in question as follows:—

Nerve stout throughout the leaf	*robustum*.
Nerve narrow throughout, distinct above	*pungens*.
Nerve variable below, wide and indistinct above . .	*setosum*.

The subula of *D. setosum* varies considerably in length and in serrulation; it is usually very finely setaceous, and in Hooker's specimens usually subentire or only finely and rather distantly denticulate, but I cannot separate other plants with much rougher subula. The leaves in *D. setosum* are frequently very fragile.

Renauld places *D. setosum* among the species having the *Toroneuron* type of nerve. This is probably typically the case, but I have sectioned leaves of specimens from Mitten's herbarium from Hawke's Bay (probably out of the Hookerian herbarium) in which the nerve is very variable, sometimes showing traces of internal stereid bands, but at others certainly of the *Heteroneuron* type, while in other specimens I have found it intermediate in character. I am compelled to the conclusion that in this species the type of nerve is plastic and unreliable as a specific character. I have found the nerve at least twice as wide in the lamina of one leaf as in another from the same portion of the same stem in a typical specimen of *D. setosum* (W. 26*b*, in Herb. Hook.).

After much hesitation I have come to the conclusion that *D. subpungens* Hampe must be referred to the present species. I have examined the type in Hampe's herbarium, and am unable to detect any difference between it and, *e.g.*, Hooker's Campbell Island specimens of *D. setosum* (W. 26). Hampe's note on his species indicates that it differs from *D. pungens* principally in the theca shorter and strumose, implying that the theca in *D. pungens* is not strumose. The type specimens of *D. pungens* in Hooker's herbarium, however, show the capsule distinctly though not strongly strumose, and variable in length, so that the most that can be said of *D. subpungens* in comparison is that the capsule is slightly shorter and somewhat more markedly strumose than is usual in *D. pungens*. The capsule in *D. setosum* in Hooker's herbarium is just like that of *D. pungens*, distinctly strumulose and rather elongate, but it appears to vary in both these respects, just as it does in *D. pungens* and also in *D. subpungens*. The leaf form and structure in *D. subpungens* appear to me exactly the same as in *D. setosum*, the nerve, as in that, variable in width below, but often enlarging and always wide and ill defined above.

I have examined the type of C. Müller's "*Dicranum calymperaceum* n. sp., Australia—Queensland. *leg.* Bailey, 1884 : misit Kiaer." There is nothing either in the description or in the specimen to separate it from *D. setosum*, except that the author describes the habit as "calymperoid," and compares it with *D. calymperoideum* in this respect. This latter, however, is a true *Leucoloma*, while *D. calymperaceum* is absolutely similar in habit to typical *D. setosum*.

The type of *Dicranum subsetosum* in C. Müller's herbarium also exhibits no difference from *D. setosum* except in the fragility of the leaves, which is a not infrequent state of *D. setosum*, and obtains to some extent even in the ordinary forms, so as to be scarcely, I think, worthy of a varietal name. It occurs markedly in some New Zealand specimens which I have received under the name of *D. subpungens*.

D. selenicarpum C. M. (ined.), type in C. Müller's herbarium, "Half-moon Bay, Stewart Island ; coll., W. Bell ; No. 743." ex herb. Beckett, is also, in my opinion, inseparable from *D. setosum*. The character whence the specific name is drawn is derived from the capsule, which gathered in a slightly immature condition is rather elegantly curved and crescent-shaped with a tapering base ; but old capsules which had become fully matured before drying show the normal wider, strumulose form characteristic of this group of species. The two forms on the same specimen afford a very striking illustration of the want of value to be attributed to the strumose or estrumose character, except as judged from the fully matured capsule. In other respects *D. selenicarpum* shows no difference from *D. setosum*.

C. Müller (Synops., i. 368) emphasizes the dimorphous character of the alar cells, the lowest marginal ones being elongate and large. I do not, however, find them in any way different from those of the rest of this group, where the alar cells along the lines of insertion are generally, in one or two rows, markedly longer and narrower than the quadrate upper median ones.

7. Dicranoloma grossialare (C. M.) sp. nov. [Plate I, fig. 4.]

Syn. *Dicranum grossialare* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*).

Perrobustum. Caulis 6–8 cm. altus, parce ramosus. Folia *dense conferta*, patentia, *vix secunda*, suprema in penicillum tenue suberectum aggregata, sicca flexuosa, praelonga (1·3–1·6 cm.), e basi *breviuscula*, 1 mm. lata, superne valde convoluta, sensim in subulam longam setaceam *carinatam vel subplanam nec convolutaceam* angustata, marginibus per partem subulae superiorem minute, apicem versus argutius nec grosse dentatis. Costa supra *valida, basin versus tenuis*, saepe indistincta, in media lamina circa 80–120 μ lata (in sectione typum *Toxoneuron* exhibens, ducibus 4–6, stereideis perpaucis inconspicuis externis saepius substereideis), *superne pernotata, dorso valde prominens*, sublaevis, apicem versus excurrentem tantum denticulata. Cellulae alares numerosae, magnae, *auriculas magnas dilatatas* purpureas formantes. Rete basilare elongatum, e cellulis perincrassatis perporosis instructum, ad marginem 1–2 seriebus angustissimis decoloratis, limbum perangustum sat bene notatum praebentibus : cellulae subulae *elongatae* (4–10 × 1), *bene definitae*, parietibus tenuiusculis, porosis : marginalibus superne saepe distincte *brevioribus*, subobliquis, denticulationes formantibus.

Perichaetia *longe exserta*, ad. 1·6 cm. longa, foliis inferioribus breviter vaginantibus in aristam subaequilongam subito contractis, superioribus perlonge cylindraceis, arista breviuscula cuspidatis. Seta (cum perich.) 2–2·5 cm. alta, *crassiuscula* ; theca oblongo-cylindrica, inclinata, leniter curvata, *estrumosa*, 3–3·5 mm. longa ; peristomium intense purpureum.

Hab.—"Nova Seelandia, insula meridionalis, Mount Arthur Plateau, Nelson, alt. 4,000 ft., 1889, misit T. F. Cheeseman, No. 66 (sub nomine '*Dicranum robustum* H. f. & W. ?'), ex herb. Levier."

Type in Herb. C. Müll., in Mus. Bot. Berolin.

A fairly well marked species, with distinct habit ; the very long, setaceous, flexuose leaves are characteristic, the uppermost gathered into a fine, delicate pencil, which at first sight is scarcely distinguishable from the young perichaetia. The upper cells separate it at once from *D. platycaulon* and *D. cylindropyxis* ; the non-tubular subula, the nerve, distinct, prominent, and subterete in the subula, but becoming weaker below, together with the narrower-walled, distinct upper cells, from *D. robustum*. The shorter, stouter seta, and the scarcely curved estrumose capsule, are also, when present, characters of importance. *D. chrysodrepaneum* most nearly resembles it, but appears to be distinct in the leaves falcato-secund, less longly setaceous, tubular above and with shorter cells, the denticulation of the margin finer and closer, and the nerve stouter at base.

Renauld gives this species as exhibiting the *Toroneuron* type of nerve. It appears to me rather (as in *D. setosum*) intermediate between that and the *Heteroneuron* type.

8. Dicranoloma chrysodrepaneum (C. M.) sp. nov. [Plate II, fig. 5.]

Syn. *Dicranum chrysodrepaneum* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*),

Robustum ; habitu *D. grossialari* simile, sed foliis *minus confertis, falcato-secundis*. Caulis 5 cm. altus (in speciminibus leg. Meiklejohn ad 12 cm.), parce divisus, subnitens. Folia similia sed *paullo breviora*, 1–1·3 cm., superne *canaliculata vel subtubulosa*, ad margines et dorsum sublaevia vel saepius plus minusve densissime denticulata. Costa valida, infimam versus basin aliquando angustata, in subula *minus definita*, dorso *minus prominens* ; cellulae apicem versus saepissime *breviores*, longitudine autem variabiles. Perichaetium, seta et theca eis *D. robusti* subsimiles.

Hab.—"Nova Seelandia, Greymouth, reg. litoral. austral. insulae australis, R. Helms leg. et mis., 1886" (Herb. C. Müll.). Near Lake Wakatipu, South Island, September, 1906, leg. J. Meiklejohn ; comm. Rev. D. Lillie (Nos. 1, 7).

Type in Herb. C. Müll., in Mus. Bot. Berolin.

This seems to me a fairly good species, though nearly allied to *D. grossialare* and still more closely to *D. robustum*. The leaves are distinctly less longly setaceous than in the former species, and with the subula subtubular and the nerve there less prominent and less distinct. The upper cells are very variable, and at times scarcely distinguishable from those of *D. grossialare*, but are nearly always shorter (though, being also often more incrassate, the proportional length is not always decreased), and frequently very markedly so. The denticulation of the leaves varies also very greatly ; in Meiklejohn's specimens the subula both at base and margin is exceedingly scabrous with close fine teeth ; in C. Müller's type the lower leaves are often subentire to the very apex, while the upper leaves on the same stem are strongly though always closely and finely denticulate, and spinulose at back.

The seta may be a shade less stout, but in other respects the fruiting characters appear identical with those of the previous species. Meiklejohn's specimens are sterile; No. 1 is more robust and dense-leaved, though shorter than No. 7, and more closely resembles the type, but both are identical in structure. They were originally sent to Dr. Brotherus for determination, and were returned as *D. Billardieri*, but this was certainly an oversight, as neither in nerve nor general leaf-structure are they near that species (though No. 7 resembles robust forms in general habit).

D. chrysodrepanum is very close to *D. robustum*, and principally differs in the upper areolation, which is here very distinctly shorter; the nerve also is narrower and of slightly different structure, and the leaf-base smaller, shorter, and narrower. The perichaetium also is somewhat longer, and the seta shorter than in the fruiting *D. robustum* which I have seen.

9. Dicranoloma leucolomoides (C. M.) comb. nov.* [Plate III, fig. 11.]

Syn. *Dicranum leucolomoides* C. M. in Bot. Zeit., 1851, p. 540. *Leucoloma dicranoides* Broth. in Engler and Prantl, Musci, p. 323 (1901). *Dicranoloma dicranoides* Par., Ind., ed. ii, p. 26 (1904).

Distribution.—New Zealand: Kaipara, *leg.* Mossman; North Canterbury, 1892, *leg.* Beckett (det. C. Müller); Mount Cook district, alt. 2,500–5,000 ft., *leg.* Murray, December, 1907; Tapanui, Otago, 1891, *leg.* D. Petrie (sub nomine *D. setosum*); in large patches on the ground in *Fagus* forests, Kowai, Mount Torlesse, *leg.* Beckett, No. 165*b* (det. C. Müller); Rough Gully, Bealey River, *leg.* Beckett (*cf.* Beckett in Trans. N.Z. Inst., vol. 26, 1893, p. 277). (The above are in my herbarium.)

I have in my possession a specimen from Mitten's herbarium, kindly sent me by the New York Bot. Garden, labelled "*Dicranum* (*Oncophorus*) *leucolomoides* C. M., on trunks of trees and damp forests near Kaipara, N.Z., Mossman; 715. Type." This is entirely *dicarpum*, in good fruiting condition, and explains why Mitten has referred the present plant to *D. dicarpum*—owing, no doubt, to Mossman having gathered the two together, and only the latter having been received by Mitten. *D. leucolomoides* is quite a different plant, and its relationship seems closer, perhaps, to *D. setosum* and *D. pungens* than to any of the other species. It is a very much misunderstood plant, owing, no doubt, to wrongly identified specimens having been distributed; but if I have formed a true conception of C. Müller's plant (based upon Beckett's specimen determined by Müller—I have not seen Müller's type) it is a much more slender plant with more distant leaves than the usual forms of the above species, with narrower nerve and much smaller leaves narrower at the base. In other respects it differs scarcely at all from *D. pungens*, and may ultimately have to be reduced to that species as a small and slender form. The upper cells, however, exhibit some slight difference, being small, narrow, and distinct, resembling those of *D. grossialare*, the marginal shorter, oblique, and forming the denticulations. From slender forms of *D. setosum* it is best distinguished by the narrower nerve, remaining narrow and comparatively well defined in the subula; and by the more distinct less incrassate upper areolation. I have not been able to detect any distinguishing fruiting characters. The nerve is quite different from that of *D. Billardieri* (I find it rather *Heteroneuron* than *Toroneuron* as described by Renauld, but it may be doubted if he had seen C. Müller's true plant), and the upper perichaetial bracts are distinctly aristate.

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* N.B.—Brotherus altered C. Müller's specific name to *dicranoides* on referring the species to *Leucoloma*, to avoid the absurdity of the combination *Leucoloma leucolomoides*. It is not evident why Paris, placing it under *Dicranoloma*, retains Brotherus's name; I have here restored C. Müller's, as having the priority.

10. **Dicranoloma pungens** (H. f. & W.) Par., Ind., ed. ii, p. 29 (1904). [Plate I, fig. 3.]

Syn. *Dicranum pungens* H. f. & W. in Lond. Journ. of Bot., 1844, p. 542. *D. robustum* var. *pungens* H. f. & W., Handb. of the N.Z. Flora, p. 412 (1867). *Leucoloma pungens* Broth. in Engler and Prantl, Musci, p. 323 (1901).

Distributed throughout the subantarctic region.

I have felt very doubtful about retaining this as a species. In habit and size it is one of the most variable of the group, and the Hookerian herbarium contains forms from the most slender, with distant erect small leaves resembling *D. leucolomoides*, up to the most robust, with densely crowded falcate leaves like strong states of *D. robustum*, while in the var. *lucidum* (Wils. MS.) the leaves are lax and elegantly circinate. Wilson evidently felt the difficulty of defining it, and in the Handbook it is reduced to the rank of a var. of *D. robustum*, though the characters given there as to perichaetia and capsule are by no means borne out by the specimens in Hooker's herbarium. The one character which appears to be constant throughout the forms, unrecognized by the authors but apparently separating it definitely from *D. robustum*, is the character of the nerve, which is not *Toroneuron* as in that species, but *Heteroneuron*. I have verified this on original specimens (Kerguelen's Land, W. 250, in Herb. Hook.), and find it clearly of the *Heteroneuron* type. Moreover, it appears to be constantly narrower, both above and below, than in either *D. robustum* or *D. setosum*, about 60–80 μ wide in the lamina, and in the subula narrowed and remaining well defined. The upper cells do not seem to differ from those of *robustum* and *setosum*, nor can I detect any differences in the fruiting characters. The leaves are probably always narrower and smaller at the base than in the ordinary forms of *robustum*.

"*D. pungens*, W. 27, Campbell Island," in Herb. Hook., has a broad strong nerve and large wide leaves, and I believe it to be properly referred to *D. robustum*.

Renauld, it is true, places *D. pungens* under the species having the *Leptoneuron* nerve, but if this is the case with some of the weakest forms it is certainly not so usually, nor in the type specimens. If it actually is *Leptoneuron* at times, it emphasizes the differences from *D. robustum*.

11. **Dicranoloma cylindropyxis** (C. M.) sp. nov. [Plate II, fig. 6.]

Syn. *Dicranum cylindropyxis* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*).

Perrobustum; habitu *D. robusti*, aurescens, nitidum. Caulis 10–12 cm. altus, distanter ramosus. Folia conferta, falcato-secunda, praelonga (1–1·3 cm.), e basi latiore concavo (1 mm. et supra lato) sensim in subulam longam setaceam *canaliculatam subtubulosam* angustata, marginibus inferne angustissime limbatis, superne *per totam subulae longitudinem minute densissime denticulatis*. Costa infra valida, ad 100 vel 120 μ lata, superne *perdistincta*, valida, dorso *valde prominens*, excurrens, prope apicem dorso argute dense denticulata; in sectione typum Heteroneuron proxime exhibens, ducibus 4–6, cellulis stereideis hic illic perpaucis, vel nullis, externis substereideis, cellulis laminae parietibus (in sectione transversa) ventralibus et dorsalibus perincrassatis, lumen angustissimum monstrantibus. Cellulae alares magnae, auriculas saepe inaequales paullo dilatatas formantes, reliquae inferne incrassatae, valde porosae, superne *sensim breviores* in tota subula *perbreves*, 2–4 × 1, elliptico-ovales, parietibus tenuibus vix porosis, marginales minores, obliquae. Perichaetia *longissima*, 1·5–2 cm. longa, saepe $\frac{3}{4}$ longitudinem setae aequantia, bracteis omnibus longe aristatis, superioribus elongate tubulosis. Seta 3·5–4 cm. longa, theca *elongate anguste cylindrica*, deoperculata 4–4·5 mm. longa, leniter arcuata, substrumulosa. Operculum longirostre.

Hab.—"Nova Seelandia, Greymouth, pr. Christchurch, ins. australis; R. Helms leg. et mis. 1886. Paparoa Range, circa 500 met. alt." A second specimen on the same sheet, ex herb. Beckett, "166, *Dicranum robustum* ' On trees, Kelly's Range, Westland, 1892." (Both these in C. Müller's herbarium). "New Zealand, Colenso," as *D. robustum* in Herb. Mitt., comm. New York Bot. Gard.; Kelly's Creek, Westland, and Mount Cargill, Dunedin, 1890, leg. et comm. D. Petrie (sub nom. *D. robustum*); Mount Holdsworth, Tararua, leg. W. Gray.

Type in Herb. C. Müller, in Mus. Bot. Berolin.

A fine species, distinct in the form and size of the capsule, the excessively long perichaetia, and the markedly short upper cells. The leaves, more enrolled from near the base, give the plant a distinct appearance when dry from that of *D. robustum* and others of the broader-leaved species.

In Petrie's plant from Kelly's Creek the capsules, while of the same form, are much shorter than in the type; in the Mount Cargill specimen, on the other hand, they are equally large, with an elegantly decurved lid almost as long. The setae in this specimen are slightly longer and the perichaetia slightly shorter than in the type, so that the seta is about half exserted.

12. Dicranoloma plurisetum (C. M.) sp. nov. [Plates II, III, fig. 7.]

Syn. *Dicranum plurisetum* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*). *D. pallido-splendens* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*).

Valde robustum, *aurescens*, nitidum; caulis ad 6 cm. altus (in specimine leg. Petrie ad 14 cm.), ramis paucis saepe recurvatis ascendentibus. Folia conferta, *robusta*, *regulariter falcato-secunda*, e basi *perlata* (1·25–1·75 mm.), sensim in subulam *perbrevem*, *latiusculam*, *carinatam haud canaliculatam* angustata, marginibus infra *late*, *perdistincte* hyalino-limbatis, integris, *prope apicem tantum grosse argute spinoso-dentatis*. Costa angusta, circa 60 μ lata, per totam fere foliam subaequalis, in acumine *perdistincta*, dorso valde prominens, *per tertiam vel dimidiam partem superiorem folii seriebus duabus argute grosse spinoso-dentata*; sectione transversa typum Heteroneuron exhibens, ducibus 4–6, stereideis nullis, epidermicis ventralibus parvis substereideis, dorsalibus majusculis. Cellulae alares auriculas magnas dilatatas saepius inaequales instruentes; ex laminae inferiores elongatae, parietibus valde porosis male notatis conflatae, superiores *omnes elongatae*, parietibus incrassatis indistinctis valde porosis. Perichaetium, seta et theca eis *D. dicarpi* (*formae polysetae*) similes, theca substrumulosa, siccitate subplicata.

Hab.—"Nova Seelandia, insula septentrionalis: *Fagus* forests, Poverty Bay, January, 1880; leg. T. F. Cheeseman." (Type in Herb. C. Müll., labelled further, mis. E. Levier sub nomine "No. 55 bis, *Dicranum polysetum* Hampe!"). Kelly's Range, Westland, ex herb. Beckett (sub nom. *D. dicarpum*); Lake Te Anau, Southland, and Mount Cargill, Dunedin, leg. et comm. D. Petrie (sub nom. *D. dicarpum*). It further exists in C. Müller's herbarium as "*D. pallido-splendens* n. sp., Nov. Seel., australis, Greymouth, Paparoa Range, Grafschaft Grey, ca. 700 met. alt., R. Helms leg. et mis., 1888." And on the same sheet a second specimen. "*D. pallido-splendens* n. sp., var. *polypelma*, Nov. Seel., insula australis, Pakihi, R. Helms leg., iv, 1887, et mis. 1888." Both these are certainly *D. plurisetum*, and I can see nothing to separate the latter as a variety. Some of the capsules in the Greymouth plant have the struma scarcely developed, but these are usually old and shrunken, and others show it fairly well developed. It probably exists in other herbaria as *D. dicarpum* or *D. polysetum*.

D. plurisetum is a good species, in habit and in the plurisetous inflorescence resembling closely the polysetous form of *D. dicarpum*, but entirely different in the elongate upper areolation, the remarkably spinose nerve, and the leaves not biplicate below, and dentate in the upper portion only of the subula, which is much broader and shorter. The subula, indeed, is very short compared with most of the New Zealand species. The hyaline border also is remarkably broad and distinct.

This species is especially interesting in the light it throws on the taxonomic position of *D. dicarpum*. The peculiar upper areolation of the latter plant suggests at once a *Leucoloma*, and, while Renauld has shown good reasons for retaining it in *Dicranoloma*, he admits its unique position. So distinct, in fact, he felt it to be that he was inclined to minimize the value of the fruiting characters of *D. angustum* Hampe (*D. Whiteleggei* C. M.), and treat it as a regional race of *D. dicarpum*, on account of its absolute identity in leaf structure with that species. *D. plurisetum*, however, throws a new light on the position. It clearly forms a connecting link between *D. dicarpum* and the remaining species of *Dicranoloma*. It has many characters in common with *D. dicarpum*; the peculiar armature of margin and nerve, the wide border, and the sporophytic characters generally are all very similar in the two, and the upper areolation in *D. plurisetum* shows just so much differentiation between the marginal and the juxtacostal cells as to indicate a clear affinity to *D. dicarpum*, while at the same time the inner cells are so pronouncedly elongate and porose as to show no departure whatever towards the *Leucoloma* type. It therefore strongly confirms the accuracy of Renauld's view of *D. dicarpum* as a *Dicranoloma*.

13. **Dicranoloma Billardieri** (Schwaegr.) Par., Ind., ed. ii, p. 24 (1904). [Plate IV, fig. 12.]

Syn. *Dicranum Billardieri* Schwaegr., Suppl. ii, p. 70 (1816). *Oncophorus Billardieri* Brid., Bry. Univ., i, 401 (1826). *Leucoloma Billardieri* Broth. in Engler and Prantl, Musci, p. 323 (1901). ? *Dicranum angustinerve* Mitt. in Journ. Linn. Soc., 1859, p. 68. ? *Dicranoloma angustinerve* Par., *op. cit.* ? *Leucoloma angustinerve* Broth., *op. cit.* *Dicranum austro-congestum* C. M. in Hedw., 1897, p. 356. *Dicranoloma austro-congestum* Par., *op. cit.* *Leucoloma austro-congestum* Broth., *op. cit.* *Dicranum orthopyxis* C. M. in Hedw., 1897, p. 362. *D. Baileyanum* C. M. in Hedw., 1897, p. 356. *Dicranoloma Baileyanum* Par., *op. cit.* *Leucoloma Baileyanum* Broth., *op. cit.* *Dicranum subconfine* C. M. in Hedw., 1897, p. 353 (haud *D. subconfine* Besch., Not. M. des I. S. Paul et Amsterdam, p. 4, 1875). *D. scopelloides* Par., Ind., Suppl., p. 125 (1900). *Dicranoloma scopelloides* Par., Ind., ed ii, p. 30 (1904). *Leucoloma scopelloides* Broth., *op. cit.* *Dicranum pelliceum* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*). *D. turgidum* C. M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*).

Distribution.—Western South America, from Peru to Patagonia; the whole Australasian region; and the subantarctic islands of New Zealand.

D. Billardieri may be looked upon as the type of the group of Australasian species with very narrow and weak (*Leptoneuron*) nerve. Although a widely distributed species, and, like most such, no doubt somewhat variable, I have not found it to be so in any such degree as to explain the above somewhat formidable synonymy. For the greater part of this we are indebted to a number of species chiefly from the Australian Continent, for the bulk of which, I am compelled to say, there seems not the slightest justification. I have examined the types of all C. Müller's species cited above, both those published in Hedwigia (1897) and those which remain unpublished in his herbarium, and in nearly every case have failed to find any appreciable departure from the ordinary forms of *D. Billardieri*. In *D. turgidum* and *D. pelliceum* (C. M. ined.) the capsule shows scarcely any trace of struma, but this is not infrequently the case with *D. Billardieri* when gathered in certain stages, even though apparently mature.

I have part of the original plant of *D. austro-congestum* C. M. (Fitzroy Falls, Mossvale, Victoria, 1884, *leg.* Whitelegge), and I can only see in it a slender form of *D. Billardieri*. C. Muller describes the cells as having the walls non-porose, but I find them distinctly porose, though somewhat less incrassate than is, perhaps, usual in *D. Billardieri*. There is nothing else in his description of either this or *D. Baileyanum* to indicate any difference from *D. Billardieri*, to which most certainly both must be referred.

In C. Müller's herbarium are two specimens labelled "*D. Sullivani* C. M. n. sp." Of one, which is the type (Mount William, Victoria, Sullivan, 1882), I have not seen sufficient material to be able to form a judgment, but it is in all probability inseparable from *D. fasciatum*. The other (Victoria, Healesville, *prope* Melbourne. Fernshaw, 1897) is different, and is certainly *D. Billardieri*.

The description in Hedwigia of *D. orthopyxis* suggests no difference from *D. Billardieri* except that the inner perichaetial bract is described as "apice . . . raptim acumine subulato serrulato coronata," and the capsules as "erecta parva cylindrica." Part of the type specimen was sent me from Berlin, but it contained no capsule sufficiently mature for examination. Dr. Mildbraed has, however, kindly at my request examined the specimen, and has sent me the following note: "In dem Original von *Dicranum orthopyxis* C. Mull. ist nur eine alte Kapsel vorhanden, und diese ist durch das Pressen ganz flach gedruckt! Die Insertion der Seta in die Kapsel ist nicht ganz symmetrisch." It will generally be agreed that a single old capsule in a not very good state of preservation affords an insufficient basis for the foundation of a new species. There remains the perichaetium. That which I examined, and which, being quite young, was probably perfect, showed the innermost perichaetial bract with an extremely short point, and certainly did not suggest any difference worth noting from *D. Billardieri*. C. Müller's description would seem to imply a longer point, but the terms used do not necessarily involve this, and, in any case, I do not think any great weight need be attributed to it. I have therefore no hesitation in considering *D. orthopyxis* as at most a slight form of *D. Billardieri*.

I am strongly of opinion that *D. angustinerve* Mitt. must also be referred here. Mitten himself expresses some hesitancy as to its distinctness. I have received two specimens from his herbarium purporting to be this species, one of them from Taranaki, N.Z., *leg.* Jupp, which was entirely

D. platycaulon C. M.; the other, from "Westland, 1872, A. R. Bloxam," also contained *D. platycaulon* principally, but there is a single stem which is probably Mitten's actual plant. It very nearly resembles *D. Billardieri*, a slight difference in the upper cells, which are shorter and wider, thin-walled and non-porose, being the only distinction I can find. Mitten, however, does not give this as a character of his species; in fact, he describes the cells as "elongatis," so that the distinction, such as it is, cannot be taken into account. The difference in the relative lengths of lamina and subula, I am convinced, from my study of *D. Billardieri*, is not one that would remove the plant out of the range of that species, and there seems to remain only the character drawn from the perichaetium, the upper bracts of which in *D. angustinerve* are described as "subito in acumen breve setiforme angustatis," to which Mitten adds "the internal perichaetial leaves are also furnished with a bristle-like point, which seems wanting in *D. Billardieri*."* The perichaetia in *D. Billardieri* have certainly, usually and normally, the innermost perichaetial bract obtuse and quite muticous, the outer ones with very short points as compared with those of most of the New Zealand species of the genus. But it is very doubtful whether the entire absence of a mucro or cuspidate point to the innermost bracts is an absolutely constant feature. It is a problem extremely difficult of proof, because the slender points of the bracts are so brittle that their absence in very many cases is accidental and cannot be held a proof of non-development. Moreover, Mitten, in describing *D. Billardieri* in the "Musci Austro-Americani," has of these bracts "apicibus muticis retusis mucronatisve." And, further, one or two species (*cf*. *D. orthopyxis*, above) have been separated from *D. Billardieri* principally on the ground of the cuspidate perichaetial bracts, a character which I think it must be held, if unsupported by other differences, is a very unsatisfactory basis for the foundation of a new species. I am inclined to think that a certain amount of latitude in this direction must be conceded to *D. Billardieri*, in which case *D. angustinerve* may certainly take rank under the present plant. I do not, however, feel able to give a final opinion, the more that I have not examined the original specimen (Tasmania, *leg*. Archer) on which Mitten founded his species. In support of the above view, however, it may be mentioned that Kirk (*cf*. Boswell in Journ. of Bot., 1894, p. 83) wrote that he considered *D. turgidum* C. M. to be equivalent to *D. angustinerve* Mitt., and *D. turgidum*, as mentioned above, is certainly *D. Billardieri*.

The var. *enervosum* Boswell (Journ. of Bot., 1894, p. 81) is a form with nerve frequently evanescent, but scarcely, I judge, of sufficient importance to be maintained, *D. Billardieri* being eminently variable in this respect.

I have a specimen labelled "*D. Billardieri* var. *duriusculum* Hook., New Zealand, *leg*. P. Yates, 1894," sent me by Rev. C. H. Binstead, and probably communicated by T. W. N. Beckett. I scarcely know the value of the variety, nor can I say whether the specimen is accurately named. The characters scarcely seem to warrant its varietal rank. The seta, which is described for var. *duriusculum* as longer than in the type, is here rather shorter, so that the authenticity of the identification may be questioned.

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* R. Brown, in his "Notes on the Genus *Dicranum*" (Trans. N.Z. Inst., vol. 29, p. 461, 1897), writes that the perichaetial leaves of *D. Billardieri* end in a short toothed hair-point. I do not know if this was from his own observation or deduced from descriptions and the analogy of other species; it would seem probably the former, as he figures the innermost bract with a short mucro, or cuspidate point.

14. **Dicranoloma fasciatum** (Hedw.) Par., Ind., ed. ii, p. 26 (1904). [Plate IV, fig. 13.]

Syn. *Dicranum fasciatum* Hedw., Sp. Musc., p. 127 (1801). *Leucoloma fasciatum* Broth. in Engler and Prantl, Musci, p. 322 (1901). *Dicnemon obsoletinerve* Hampe and C. M. in Linn., 1853, p. 496. *Leucoloma obsoletinerve* Broth., *op. cit.* *Dicranoloma obsoletinerve* Par., *op. cit.*, p. 28.

Distribution.—New Zealand : North and South Islands.

I have examined several specimens of *Dicnemon obsoletinerve* Hampe and C. M., including a specimen ex herb. C. Müll., *leg.* Beckett, kindly sent me by Dr. Brotherus, and find them absolutely identical with *Dicranoloma fasciatum*. If C. Müller's description of *D. obsoletinerve* in Linnaea be compared with his description of *Dicranum fasciatum* in the Synopsis, it will be found that they entirely agree, except that the former is described as "laxissime foliosus" and the latter as "f. confertissima." But the specimens of *D. obsoletinerve* do not bear out that description, and in Beckett's plant, determined by C. Müller, the leaves are as closely set as in ordinary *D. fasciatum*. The same is the case with a plant collected and sent me by Mr. Petrie, also identified by C. Müller. The fruiting characters, which are so striking as to have caused Hampe and C. Müller to place their species (not unnaturally) under *Dicnemon*, are absolutely identical in both. The explanation is probably that neither Hampe nor C. Müller (at any rate, in 1853) knew Hedwig's plant; the brief description of the latter in the Synopsis, indeed, states this to have been the case with C. Müller at least.

The nerve in *D. fasciatum* varies in the lower part of the leaf from fairly well marked to faint or almost invisible ; in the subula it is always stronger and distinct. The serration of the leaves above is somewhat coarse, as in *D. Billardieri* ; the upper cells are elongate, but rather lax and irregular ; and the border is broad and well defined to quite high up in the leaf. The general form of the leaf and its armature recall *D. plurisetum* and the shorter-leaved forms of *D. dicarpum* ; the walls of the upper cells are thin, but frequently somewhat porose, and the "primordial utricle" is often very noticeable. The species is usually found fruiting, and is then at once recognizable from the perichaetia, which reach and often overtop the capsules.

15. **Dicranoloma Pungentella** (C. M.) Par., Ind., ed. ii, p. 29 (1904). [Plate IV, fig. 14.]

Syn. *Dicranum Pungentella* C. M. in Hedw., 1897, p. 355. *Leucoloma Pungentella* Broth., in Engler and Prantl, Musci, p. 323 (1901). *Dicranum leucolomopsis* C.M. MS. in herb., et Gen. Musc. Frondos., p. 290 (*nomen*). *D. Weymouthi* C. M. in Hedw., 1897, p. 354. *Leucoloma Weymouthii* Broth., *op. cit.* *Dicranoloma Weymouthi* Par., *op. cit.*

Distribution.—Tasmania, New Zealand.

I have recorded and figured this species from Mauriceville, N.Z. (*leg.* W. Gray), in Journ. Linn. Soc. (Botany), vol. 40, p. 436, t. 20, where also I have given reasons for considering *D. leucolomopsis* C. M. identical with it.

It may be doubted whether *D. Pungentella* (and the doubt might extend to *D. integerrimum*) may not ultimately have to be referred to *D. Billardieri*. The only vegetative characters to separate it (for the habit and leaf-direction quite fall within the range of *D. Billardieri*) are the somewhat more tubular, often twisted subula, and the practically entire leaves. Nerve, cells, and fruiting characters show no departure whatever. When one compares the well-known variation of such a plant as *Dicranum scoparium* it is obvious that the above characters might very well not mark anything more than a varietal departure from the type. At the same time, intermediate forms rarely seem to be recorded, and, though I have some evidence that they occur, it needs perhaps to be strengthened before uniting *D. Pungentella* with *D. Billardieri*. Moreover, *D. Pungentella* does not appear to be a commonly distributed plant, and at Mauriceville it grows actually intermixed with a quite ordinary form of *D. Billardieri*, each keeping their characters—such as they are—quite distinct, so that, whatever its value, it is by no means only a local or temporary state conditioned by the environment.

A careful examination of *Dicranum Weymouthi* C. M. (Tasmania, 1889, *leg.* W. A. Weymouthi), sent me by Dr. Brotherus, reveals no characters that can separate it from *D. Pungentella*. There is nothing in the description to indicate any difference, and the only possible distinguishing mark to be found consists in the leaf apex, which is at times somewhat more strongly toothed than I have seen it in *D. Pungentella*. The leaves, however, range from this form to quite entire, and the larger proportion of them are absolutely indistinguishable from those of *D. Pungentella*. It is simply a form with leaf-apex frequently more markedly denticulate. As such it reduces somewhat the specific value of *D. Pungentella* as distinct from *D. Billardieri*.

In actual *place* of publication *D. Weymouthi*, being described on p. 354, and *D. Pungentella* on p. 355, has the technical priority. But as *D. Weymouthi* has not been cited, so far as I am aware, in subsequent literature (except in company with *D. Pungentella*), while *D. Pungentella* has been described and figured under that name (as *Leucoloma*), as cited above, I have thought it best to retain the latter name.

16. Dicranoloma integerrimum (Broth. & Geh.) Par., Ind., ed. ii, p. 27 (1904). [Plate IV, fig. 15.]

Syn. *Dicranum integerrimum* Broth. & Geh. in Oefv. af Finsken Vet. Soc. Forh. 1895, p. 152. *Leucoloma integerrimum* Broth. in Engler and Prantl, Musci, p. 323 (1901).

Distribution.—Tasmania; New Zealand—Stewart Island, October, 1908, *leg. et comm.* Cockayne.

As the figures will show, *D. integerrimum* is a much more robust, far more densely foliate plant than *D. Pungentella*, with the leaves terminating in a fine, rigid, almost always entire subula, with long, extremely narrow upper cells. At the same time, an intermediate plant occurs in *D. Burchardi* Par. = *Dicranum rigens* C. M. (non *D. rigens* Besch. in Bull. Soc. Roy. Bot. Fr., 1885), from Tasmania. The only marked difference between *D. Burchardi* and *D. integerrimum* is in the leaves of the former sharply denticulate for some little distance below the apex, while in the latter they are entire or at most with a few denticulations at the extreme apex. The leaves of *D. Burchardi* are, however, sometimes quite entire; still, they are also less finely subulate, and have the upper cells shorter and somewhat wider—in *D. integerrimum* they are markedly long, narrow, and straight. I do not venture, therefore, to unite them; but it may be pointed out that *D. Burchardi* forms the completing link in a series of parallel forms which I suggest may ultimately have to be reunited under *D. Billardieri*. This species has (among others) two fairly marked forms in respect of robustness

—a slender form with comparatively distant leaves, and a robust form with densely set, longer leaves. From each form I suppose a series tending to have leaves more entire, more erect, and less falcate, the more robust form culminating in *D. integerrimum*, with *D. Burchardi* as an intermediate, the more slender form in *D. Pungentella*, having the plant described as *D. Weymouthi* as its intermediate (and probably *D. confine* Hampe as a further link, still nearer to *D. Billardieri*). We have thus the parallel series :—

D. Billardieri (slender form).	*D. Billardieri* (robust form)
D. Weymouthi.	*D. Burchardi.*
D. Pungentella.	*D. integerrimum.*

The sporophyte appears to be absolutely identical, so far as known, in all these forms, which in itself is a strong indication of their close affinity.

Excluded and Doubtful Species.

Dicranum Speightii R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 461, pl. 32, fig. 22.

The herbarium of Robert Brown, unfortunately, contains no specimen of this, only the original drawings from which the plant is figured, which, unfortunately, contribute nothing towards its determination. The description lacks sufficient detail in some respects upon which to base a decided opinion, but there is nothing to indicate a difference from several of the known species, notably *D. Billardieri*, except the erect, symmetrical capsule, which would appear on the face of it to be a character of some value. In the absence of specimens, however, it is impossible to determine its true place.

Dicranum confine Hampe & C. M. in Linn., 1856, p. 206.

This species has been recorded from New Zealand "*leg.* H. Krone, 1874; ex herb. Geheeb." It was described originally from a plant of F. Müller's collecting, at Sealer's Cove, Australia. The description compares it with *D. Billardieri* and *D. leucolomoides*, and, according to the authors, it differs from the latter in having the leaves loosely patent, hardly secund, with broad base, fragile, denticulate only and not serrulate at back and margins above, with the upper cell-walls not incrassate but porose, the perichaetial bracts ending in an elongate denticulate subula. There is no specimen of the original gathering in Hampe's herbarium, but I have examined an original specimen in the possession of Dr. Brotherus, and I am quite unable to separate it from *D. Billardieri*. I do not detect any difference in the upper cells from that species, and the perichaetium shows the upper bract entirely muticous in an apparently intact specimen. I am aware how easily this may be misinterpreted, but the points which remain on the lower bracts are exceedingly short, on the second and third (proceeding outwards) almost inconspicuous (as in *D. Billardieri*), and this is quite contrary to what one would expect if the innermost bract had originally a *long* arista.

Krone's New Zealand plant exists in Hampe's herbarium, and I have a specimen in my own collection of the original gathering. This plant (which was only found sterile) is certainly only a form of *D. Billardieri*. The leaves, though mostly suberect (as described for *D. confine*), are on some of the stems in Hampe's specimen falcato-secund. The leaves are often denticulate only, but some are clearly serrated, as in *D. Billardieri*; the upper areolation is exactly as in that. Krone's plant is incontestably nothing but *D. Billardieri*, and the fact that Hampe named it *D. confine*, and that the Sealer's Cove *D. confine* mentioned above is almost equally certainly *D. Billardieri*, leaves hardly a doubt that *D. confine* is another of the names to be ranked in the synonymy of *D. Billardieri*. At the same time there is always the possibility that C. Müller had a different plant under his eye than the one which came to me (from Sealer's Cove) as *D. confine*, and without an examination of this I do not feel warranted in reducing it. In any case, Krone's plant is only *D. Billardieri*, and there is no evidence of the true *D. confine*, if such exist, being a New Zealand species.

EXPLANATION OF PLATES.

It will save space and repetition to say that figs. *a* and *b* are uniform throughout, *a* being the leaf subula × 20, *b* the cells from the lower part of the subula × 200.

PLATE I.

Fig. 1. *D. robustum* (N.Z.; Dr. Monro, ex herb. Mitt.).
Fig. 2. *D. setosum* (Campbell Island; Hooker, 266).
Fig. 3. *D. pungens* (Kerguelen's Land; Hooker, W. 250).
Fig. 4. *D. grossialare* (Mount Arthur Plateau, Nelson, 1889; Cheeseman, ex herb. C. Müller). *c*, plant, × 1. *d*, leaf, × 4. *e*, perichaetium, × 2. *f*, capsule, × 2.

PLATE II.

Fig. 5. *D. chrysodrepaneum* (Greymouth; Helms, ex herb. C. Müller). *c*, plant, × 1. *d*, leaf, × 4.
Fig. 6. *D. cylindropyxis* (Greymouth; Helms, ex herb. C. Müller). *c*, upper two-thirds of stem, × 1. *d*, leaf (not the largest size), × 4. *e*, part of subula, dorsal view, × 80.
Fig. 7. *D. plurisetum* (Poverty Bay, 1880; Cheeseman, ex herb. C. Müller). *c*, plant, × 1. *d*, leaf, × 4.

PLATE III.

Fig. 7. *D. plurisetum* (cont.). *b*.
Fig. 8. *D. dicarpum* (Ship Cove; Lyall, ex herb. Mitt.). *c*, leaf, × 4.
Fig. 9. *D. diaphanoneuron* (Austral. Felix, *leg.* F. Müller). *c*, leaf, × 4. *d*, leaf-base, × 20.
Fig. 10. *D. platycaulon* (Mount Cargill; W. Bell, ex herb. Broth.). *c*, plant, × 1. *d*, leaf, × 4.
Fig. 11. *D. leucolomoides* (Canterbury; Beckett, det. C. Müller). *c*, plant, × 1 (the capsule is drawn slightly too large). *d*, leaf, × 4.

PLATE IV.

Fig. 12. *D. Billardieri* (N.Z.; Knight, ex herb. Jaeger).
Fig. 13. *D. fasciatum* (Kaipara; Mossman, 712; ex herb. Mitt.).
Fig. 14. *D. Pungentella* (Mauriceville; Gray). *c*, plant, × 1.
Fig. 15. *D. integerrimum* (Tasmania; Moore, 1893; ex herb. Broth.). *c*, plant, × 1. *d*, leaf, × 4.
Fig. 16. *D. Menziesii* (type, *leg.* Menzies, N.Z.; ex herb. Mitt.). *b*.
Fig. 17. Nerve section (*Toxoneuron*), *D. Menziesii*, × 400.
Fig. 18. „ (*Heteroneuron*), *D. plurisetum*, × 400.
Fig. 19. „ (*Leptoneuron*), *D. Billardieri*, × 400.
Fig. 20. „ (*Cyrtoneuron*), *D. dicarpum*, × 400.

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BULLETIN No. 3.

STUDIES IN THE BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF ROBERT BROWN,
OF CHRISTCHURCH, NEW ZEALAND.

BY H. N. DIXON, M.A., F.L.S.

PART II.

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PART II.

Plates V, VI.

I. DICRANACEAE—*continued*.

BEFORE proceeding with the remaining genera of *Dicranaceae* it may be useful to give an analytical key to these genera so far as they are found in New Zealand. It should perhaps be pointed out that the characters given in the key are applicable to the New Zealand species of the various genera, but must not be taken to be "generic" characters in the broad sense.

KEY TO THE NEW ZEALAND GENERA OF DICRANACEAE.

1.	Alar cells not or scarcely differentiated (*cf.* also *Dicranoweisia*)	2
	Alar cells distinct	14
2.	Plants minute, capsule immersed or nearly so	3
	Plants larger, or, if minute, capsule fully exserted	4
3.	Capsule oval, without neck	*Pleuridium.*
	Capsule with a long, tapering neck	*Bruchia.*
4.	Capsule with a very long neck, leaves narrow and flexuose in subula	*Trematodon.*
	Neck of capsule short or none	5
5.	Plants minute, nerve in section without deuter-cells; peristome of short, broad, undivided teeth	*Seligeria.*
	Plants larger, nerve with deuter-cells	6
6.	Leaf-cells short, mammillose or papillose; leaves not subulate	7
	Upper cells frequently elongate, smooth, rarely slightly papillose	8
7.	Leaves narrow, lanceolate-subulate, cells small, upper obscure with very dense papillae	*Cheilothela.*
	Leaves broad above, not subulate	*Dichodontium.*

8. Plants covered with a blue-grey "bloom" .. .. .. *Saelania.*
Plants of ordinary colouring 9

9. Leaves markedly distichous .. .. *Distichium.*
Leaves not distichous 10

10. Seta cygneous .. .. *Campylopodium.*
Seta erect or only slightly flexuose 11

11. Alar and basal marginal cells very thin, forming a distinct hyaline margin; nerve broad .. .. *Pseudodistichium.*
Alar and marginal cells not differentiated 12

12. Capsule short, oval or elliptical, usually asymmetrical and curved .. *Dicranella.*
Capsule more or less cylindrical, erect or inclined, symmetrical or nearly so .. 13

13. Leaves not subulate, capsule strumose at base .. .. .. *Ceratodon.*
Leaves finely subulate, capsule without struma .. .. .. *Ditrichum.*

14. Capsule erect, symmetrical, more or less oval or rounded, wide-mouthed when dry, peristome teeth broad, short, flat .. .. .. *Blindia*
Capsule usually elongate, mostly asymmetrical: peristome teeth narrow, usually divided to near the base 15

15. Seta cygneous, nerve broad 16
Seta erect or flexuose, nerve usually narrow 17

16. Capsule mostly furrowed, peristome teeth broad at base, forked to about middle .. .. *Campylopus.*
Capsule smooth, calyptra fringed at base; peristome teeth more or less filiform, not wide at base .. .. *Thysanomitrium.*

17. Leaves more or less narrowed, lanceolate or subulate above 18
Leaves broad above, often obtuse 23

18. Leaf-base broad and sheathing, wider above and suddenly narrowed to subula; capsule erect, symmetrical (*cf.* also *Mesotus*) .. .. .. *Holomitrium.*
Leaf-base not distinctly broader and sheathing 19

19. Capsule immersed, primary stem creeping .. .. .. *Mesotus.*
Capsule on a longer or shorter seta, stem erect 20

20. Capsule erect, symmetrical; peristome teeth not (or scarcely) vertically striolate .. .. *Dicranoweisia.*
Peristome 0, or teeth vertically striolate on dorsal surface 21

21. Leaves not bordered .. .. *Dicranum.*
Leaves with a narrow border of extremely thin, hyaline cells; frequently indistinct, or visible only near base 22

22. Habit of *Dicranum*, all lower cells (apart from the auricles) elongate, membranaceous, smooth, not chlorophyllose .. .. *Dicranoloma.*
Habit distinct, not dicranoid, areolation of minute, not elongate, chlorophyllose cells, usually papillose, reaching nearly to base and extending lower at margins than near nerve .. .. *Dicnemon.*

BRUCHIA Schwaegrichen, 1824.

Paris, followed by Roth (Aussereuropäischen Laubm., I, 127), cites New Zealand for *Bruchia minuta* Mitt.: Roth gives no diagnosis or figure, explaining that no specimens were found in Mitten's herbarium. The citation of New Zealand is due entirely to a false reference in Paris (Handb. N.Z. Fl., p. 223), and the species has no claim—at present—to be a New Zealand one. The original gathering, "Tasmania, Archer," exists in the Kew Herbarium, and is the sole representative of the species in the collection.

The synonymy should read,—

BRUCHIA MINUTA Mitt. in Journ. of the Linn. Soc., 1859, p. 65, et in Fl. Tasman., 2, 165, t. 171, f. 4 (1860).

Syn. *Sporledera minuta* Jaeg., Adumbr., p. 223; Par., Ind., ed. 1, 1229 (1897).

Distrib.—Tasmania.

TREMATODON Michx.

The genus *Trematodon* is a difficult one to treat with clearness. In many cases the vegetative characters afford little aid in distinguishing the species, and recourse must be had to the sporophyte. This is less of a drawback than in many genera, since the species are for the most part autoicous and abundant fruiters; still, even with the presence of fruit the difficulties by no means disappear, as several of the characters relied on, such as the length of seta and its degree of flexuosity, the relative lengths of capsule and neck, and the development of the struma, are all subject to a certain degree of variation. The struma especially depends for its distinctness considerably upon the degree of maturity attained before drying, and it is desirable in all critical cases to moisten out the capsule well before forming a conclusion. Fortunately the capsules in a tuft ripen somewhat irregularly, so that, as a rule, it is possible to find, at any one time, capsules in different stages of maturity.

The most constant and most valuable character, perhaps, resides in the peristome, and the genus has been divided by Roth (Aussereuropäischen Laubm., bd. I, 1911) into three subgenera based on the peristome characters.

The fully developed peristome of *Trematodon* (subgenus *Eutrematodon* C. M.) consists of 16 rather long teeth, usually vertically striate on their dorsal surface in the lower part; at the base they are often confluent into an extremely low cylinder, while above they may be either—(1) entire or only slightly perforated here and there along the median line; (2) divided throughout their length into two more or less filiform halves, which are frequently unequal in width, and often connected here and there, especially towards base, by the transverse articulations; (3) divided—as in (2)—for some distance up, then united again in the upper half.

The type of peristome (3) is found in the greater number of species; but there may often be found in the same species, and, indeed, in the same tuft, side by side with the normal form, examples where the teeth are much more irregular, sometimes split into three divisions, here and there branched, or again very irregularly connected one with another. Types (1) and (2) are represented by a smaller number of species.

In a second, lesser group the teeth are much more rudimentary than in *Eutrematodon*, and their very short divisions not united above as in that subgenus, but more or less free throughout their length, only connected here and there by a few transverse articulations. This constitutes the subgenus *Pseudomicrodus* Roth.

A small section of *Eutrematodon* show a slight deviation from the normal types of peristome described above, in having the teeth perforated or split here and there along the median line from top to bottom. They form, therefore, a transition, to some extent, between *Eutrematodon* and *Pseudomicrodus*.

Finally, a certain number of species have the peristome entirely wanting or reduced to the basal cylinder simply—*Gymnotrematodon* C. M.

Basing our classification on this structure, we may arrange the New Zealand species as follows, affording a fairly practical key to their identification:—

Subgen. GYMNOTREMATODON C. M.

1. *Trematodon Mackayi* (R. Br. ter.) Broth.

Subgen. PSEUDOMICRODUS Roth.

2. *Trematodon flexipes* Mitt.

Subgen. EUTREMATODON C. M.

A. Peristome teeth almost entire. Neck 1½ to twice length of capsule, indistinctly strumose.*

3. *Trematodon Cheesemanii* C. M.

B. Peristome teeth split below, united above. Neck 1–1½ times length of capsule, more or less distinctly strumose.

4. *Trematodon suberectus* Mitt.

1. Trematodon Mackayi (R. Br. ter.) Broth. in Engler and Prantl, "Pflanzenfamilien," p. 292.

Syn. *Stirtonia Mackayi* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 148, tab. xvi.

This very remarkable species was described and figured by R. Brown in the paper cited above. The author very naturally created for it a new genus, based particularly on two characters—the absence of peristome and the mitriform calyptra. The former character has not been considered of sufficient value to warrant generic separation, and the plant has been included by Brotherus and Roth in the subgenus *Gymnotrematodon*. I have followed this arrangement, though by no means certain that it is the correct one, in view of the fact that the calyptra is certainly mitriform, being quite erect and symmetrical, and divided at the base into from two to four lobes. The lid, too, is extremely short compared with what is usual in the genus, judging from the one or two operculate capsules in Brown's specimen, as well as from his figure and description; and the spores are exceedingly large, 50–60 μ in diameter, and only equalled by one other species, the European *Trematodon brevicollis*. The vegetative characters do not, however, exhibit any differences from the ordinary foliage of *Trematodon*, and I hesitate, therefore, to maintain the genus *Stirtonia* on the sole base, as it would practically be, of the mitriform calyptra. The capsule is very pachydermatous, and the neck, too, of firmer consistency than in most of the species, passing abruptly at the base into the seta, not tapering gradually, but at the same time equal all round and not forming a struma. The deoperculate capsule shows remains of an annulus.

This rare species has not, so far as I am aware, been refound since collected by R. Brown on the west side of Stewart Island in 1889 and 1892.

2. Trematodon flexipes Mitt. in Fl. Tasman., 2, 173, tab. 172; Handbook, p. 115; Roth, Aussereuropäischen Laubm., 1, tab. xxv.

This plant, which I have not seen, is described and figured by Roth (from a specimen *leg.* W. Bell, ex herb. Brotherus) as a quite distinct species, having a short, indistinctly strumose neck, a small suberect capsule of equal length (only 1 mm. long), rather large spores (26–32 μ), and very short, poorly developed peristome, the teeth not united above (or but rarely so, and in that case showing a transition to *Eutrematodon*), and often irregular.

Roth refers to this species as from "northern New Zealand," but he only cites Otago (doubtless from the Handbook), and does not state the origin of Bell's specimen. Unless, therefore, as is unlikely, this were collected in the Northern Island, it does not appear to have been at present found there, though, as it occurs in Tasmania, its presence is to be expected in the Northern Island also.

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* It is perhaps as well to mention that in comparing the relative length of neck and capsule I have given the measurements of the external capsule (not the internal spore-case) from its base to the orifice—not including the lid.

A specimen in R. Brown's herbarium, labelled "*Tr. flexipes* Mitt., Kaikoura, Dec., 1889, herb. T. W. N. Beckett," is not Mitten's species. It is probably the original of *T. integrifolius* C. M., but in any case is inseparable from *T. suberectus* Mitt. The few capsules that are mature show the neck to be distinctly strumose at base, though, the greater number being unripe, it appears to taper gradually into the seta.

3. **Trematodon Cheesemanii** C. M. in Hedw., 1898, p. 110; Roth, *op. cit.*, tab. xxix.

Hab.—Sunday Island, Kermadecs, 1888; *leg.* T. F. Cheeseman.

A distinct species, judging by the description and figures, in the leaf subula broader and shorter than in most of the species, with the lamina cells more distinct to apex; and especially in the peristome teeth, which are undivided, at the most having the median line here and there somewhat pellucid by thinning, scarcely perforated.

4. **Trematodon suberectus** Mitt. MS. ex Hook. f. & Wils. in Handb. N.Z. Flora, p. 415; Roth, *op. cit.*, tab. xxv.

Syn. *Trematodon longicollis* H. f. & W., Fl. N.Z., 2, 62 (*non T. longicollis* Michx.). *T. arcuatus* Mitt. MS. ex H. f. & W., Handb., p. 415; Roth, *op. cit.*, tab. xxv. *T. integrifolius* C. M. in Hedw., 1898, p. 110.

After much hesitation I have united *T. suberectus* and *T. arcuatus*, being unable to recognize any clear grounds of distinction. In the Handbook, *T. suberectus* is described first, and the only description of *T. arcuatus* given is, "Very similar to *T. suberectus*, but the capsule is as long as its neck, and deflexed" (*T. suberectus* is described as having the capsule "nearly erect, much shorter than the somewhat curved neck"). The description leaves it uncertain whether the deflexing of the capsule in *arcuatus* is attributed to a bent seta or to a greater curving of the neck; Brotherus separates *T. arcuatus* and *T. flexipes* Mitt. from all the remaining species of *Eutrematodon* in having the seta strongly flexuose to cygneous, attributing a cygneous seta to *T. arcuatus* and "Seta sehr geschlängelt" to *T. flexipes*; while *T. suberectus* is placed with the species having a straight seta. If this were Mitten's conception of *T. arcuatus*, it would be remarkable that he made no reference to the cygneous seta in his description; whereas he suggests no distinction whatever between the form of seta in the three New Zealand species described in the Handbook (unless this is implied by the term "deflexed" above referred to), while, on the other hand, the *generic* description there given has "Fruitstalk terminal, flexuose or coiled"; and this appears to me the correct view, since the seta in *Trematodon* is normally very delicate and flexuose, varying considerably in this respect in a single tuft. I have seen no New Zealand specimens of any kind in which the seta could properly be considered as normally cygneous.

Roth, in describing the two plants, distinguishes them as follows:—*Trematodon suberectus*: Neck indistinctly strumose, 1½ times as long as capsule, erect and scarcely twisted; spores 20–25 μ. *T. arcuatus*: Neck distinctly strumose; leaves denticulate at shoulder of basal part, neck curved and strongly twisted, equal to or slightly longer than capsule; spores 22–27 μ.

Further, under *T. suberectus* he writes, "from the nearly allied *T. arcuatus* distinguished by the erect, scarcely twisted, only faintly strumose neck, and the entire basal part of the leaves." As the leaves in *T. arcuatus* are described later on as "entire or indistinctly denticulate," this latter character can have no great weight, and the difference between the two resolves itself practically into that first noted by Mitten—viz., the neck of the capsule nearly straight, scarcely twisted, and 1½ times as long as the capsule in *T. suberectus*, as against an equal or only slightly longer, much twisted neck in *T. arcuatus*, with—according to Roth—a more distinct struma. The figures given by Roth of the two plants indicate what very slight differences he finds between them, and even these slight differences I do not find borne out by the specimens in my herbarium. Thus my specimens of *T. suberectus* (near Auckland, *leg.* D. Petrie, det. Brotherus), the same plant without doubt as that figured by Roth, while showing the capsule neck usually only indistinctly strumose, has in the few more mature sporophytes a struma quite as distinct as in normal *arcuatus*, while the neck, though constantly longer than the capsule, is by no means always 1½ times its length, and, in fact, scarcely differs at all in this respect from what is often found in *T. arcuatus*. In my opinion, *T. arcuatus*, therefore, is but a slightly more robust form of *T. suberectus*, with both capsule and neck longer and slightly better developed.

T. Jonesii R. Br., MS. in herb., is also inseparable from *T. arcuatus*, and is therefore referable here. It appears not to have been published.

T. integrifolius C. M. is quite indistinguishable from the smaller forms of *T. suberectus*. I have examined the type in C. Müller's herbarium ("Clayey ground, Marlborough, Kaikoura, Dec., 1889, T. W. Naylor Beckett"), which is a small plant with small, suberect capsules, and a short tapering neck with very indistinct traces of struma. A specimen contained in Brown's collection, from Naylor Beckett's herbarium, under the name of *T. flexipes* Mitt. ("Road skirting the sea, Mangamanga Bay, Kaikoura, 6 Dec., 1889"), is most probably the same plant. It has capsules—as ordinarily in *Trematodon*—of varying sizes, the smaller agreeing exactly with the type of *T. integrifolius*, the larger, better-developed ones more inclined, and with a distinct though not pronounced struma, exactly as in normal *T. suberectus*. All the other characters of *T. integrifolius* (leaves, peristome, spores, &c.) agree exactly with *T. suberectus*.

The ♂ inflorescence in *T. suberectus* appears to be sometimes on a short basal branch, sometimes on a separate but closely connected plant (*i.e.*, rhizautoicous), which probably sufficiently explains the fact that *T. integrifolius* is described as autoicous, and *T. suberectus* as dioicous.

PLEURIDIUM Brid. (*Astomum* Hampe, p.p.).

Pleuridium is divided by Brotherus into three subgenera—*Pseudephemerum*, *Eupleuridium*, and *Sclerastomum*. *Pseudephemerum* is not represented in New Zealand. The distinctions between *Eupleuridium* and *Sclerastomum* do not appear to me to be sufficiently well defined or important to be of taxonomic value, nor are they of any great aid in the classification of specimens. Thus *Pleuridium gracilentum* Mitt. is placed by Roth under *Eupleuridium* and by C. Müller under *Sclerastomum*, while of *P. nervosum* and other species Roth remarks that they appear to show a gradation between the two. I have therefore not retained this division.

Key to the Species.

1. Seta curved, so that the capsule is laterally exserted .. .. 1. *Arnoldii.*
   Seta erect or only slightly curved 2

2. Capsule with a rather long, curved beak .. 2. *longirostre.*
   Capsule with a short, mostly straight and obtuse point 3

3. Lower leaves very short and obtuse or subobtuse, densely imbricate and julaceous so that the stem is (especially when dry) subterete; upper leaves somewhat rigid 4
   Leaves all with more or less slender and attenuated flexuose points; fertile plants not terete and catkin-like when dry .. .. 3. *gracilentum.*

4. Lowest leaves obtuse and rounded, nerveless or shortly nerved; nerve of middle leaves vanishing below apex .. .. .. 5. *curvulum.*
   Nerve of lowest and middle leaves percurrent or excurrent .. 4. *nervosum.*

1. **Pleuridium Arnoldii** (R. Br. ter.) Par., Ind., p. 571; Roth, Aussereuropäischen Laubm., I. 155, tab. xvi. [Plate V, fig. 2.]

Syn. *Phascum Arnoldii* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 303, tab. xxxviii.

The most delicate of the New Zealand species; almost stemless, pale or yellowish green, in dense silky patches, scarcely 2 mm. high. Leaves all except the basal finely setaceous, the long, flexuose subula almost entirely filled by the excurrent nerve, more or less sharply denticulate in the whole of the upper part; nerve strong, in the lower leaves shortly, in the perichaetial bracts very longly excurrent in a flexuose or curved denticulate arista. Basal cells lax, thin-walled, narrowly linear-hexagonal, above narrower, linear or rectangular. Seta and capsule of about equal length, together about 0·75 mm., the former strongly arcuate or cygneous; capsule oval-globose, minute, pale, with a short, acute, rostellate, often slightly curved beak of about ⅓ its own length. Spores 25–30 μ, irregular in outline, finely densely punctulate.

Hab.—Moa Creek, Wilberforce River, Canterbury, New Zealand (not Australia, as Roth gives it); *leg.* R. Brown. Swampy Hill, Dunedin; *leg.* D. Petrie.

A very delicate, silky plant, smaller than the European *P. subulatum*, and entirely different from the other species in the toothed, setaceous leaves and the cygneous seta.

The perichaetial bracts are certainly not shorter than the upper leaves, as R. Brown describes them, but longer, very longly and finely setaceous with the excurrent nerve (not as figured by Roth and Brown).

Mr. Petrie's plant, which was undetermined, agrees exactly with the type of *P. Arnoldii* in R. Brown's herbarium.

2. **Pleuridium longirostre** Dixon sp. nov. [Plate V, fig. 1.]

Caespites densiusculi, sericei, 2–3 mm. alti, flavo-virides. Caulis *perbrevis*, simplex vel sub perichaetio innovans. Folia infima tantum brevissima, acuta, *reliqua omnia elongate subulata* e basi concava latiore; caulina circa 1·5 mm. longa, comalia seu perichaetialia longiora, ad 3 mm., e basi multo latiore vaginante longe subulata, flexuosa, patentia; omnia *integra vel subintegra*. Costa inferne *lata*, supra male definita, excurrens. Rete *densum*, e cellulis supra *anguste linearibus*, parietibus firmis, infra paullo latioribus, linearibus, margines versus perangustis, instructum.

Autoicum. Flos masculus infra perichaetium situs, gemmiformis, rufo-fuscus, bracteis ovatis, breviter acuminatis, antheridiis paucis, circa 0·25 mm. longis, paraphysibus subaequilongis filiformibus intermixtis.

Seta *recta, circa 0·25 mm. longa*, vaginula subaequilonga, theca (cum operculo) circa 1 mm. longa, ovata, operculo *obliquo valido, tertiam vel quartam partem thecae aequante*. Spori 18–22 μ, minutissime granulati. Calyptra parva, pallida, cucullata.

Hab.—Kelso, Otago: *leg.* D. Petrie: labelled "*Phascum alternifolium*."

A well-marked species, resembling in habit the European *P. subulatum* and *P. alternifolium*. Differs at once from the previous species in the straight seta, and from that as well as from the remaining ones in the comparatively long and stout oblique beak of the capsule. The short, almost stemless habit also separates it from the following species.

3. Pleuridium gracilentum Mitt. in Journ. Linn. Soc. (Bot.), 4, 65, et in Fl. Tasman., 2, 164, t. 171.

Syn. *Astomum subexserens* C. M. in Hedw., 1898, p. 78. *Pleuridium subexserens* Par., Suppl. Ind., p. 277.

("*Astomum exserens* n. sp." C. M., Gen. Musc. Fr., p. 12, is without doubt a slip for "*A. subexserens*," as *A. subexserens* is not found there: and I am informed that no such specimen as *A. exserens* is to be found in C. Müller's herbarium.)

The two previous species belong to the group having scarcely any stem, with all the leaves elongate and subulate, except two or three at the extreme base. In the following three species the stem is more or less elongate, and the leaves gradually become longer upwards, only the comal ones being longly subulate, the remaining ones being much shorter, with scarcely or very shortly subulate points; in the dry state these are erect and closely imbricated, so that the stems are catkin-like or julaceous, especially the sterile ones. This is especially the case with *P. nervosum* and *P. curvulum*; the present species holds a somewhat intermediate position. The stems are elongate, and have to some extent the peculiar appearance when dry, but it is only the lowest leaves that are without long points, the mid-stem leaves and upper ones having distinct subulate and slightly flexuose points, the whole plant being less rigid than *P. nervosum*. The upper cells also are narrower and firmer.

The seta is straight or only very slightly curved, and the seta and vaginula combined are about the length of the capsule. The comal or perichaetial leaves are fewer than in the previous species, and are more or less foleate; and the capsule generally emerges slightly from between them. The capsule ends in a very short obtuse point.

Astomum subexserens C. M. (Tasmania, Weymouth, type in herb. C. M.) agrees exactly with *Pleuridium gracilentum*, with the slight exception that the capsule is a shade longer, and the seta a shade shorter in comparison, but the differences are of the slightest. C. Müller describes his plant as dioicous (while *P. gracilentum* is autoicous): but he does not describe the ♂ plant, implying that he had not seen it. I have found several fruiting stems of New Zealand *P. gracilentum* without any ♂ flowers, although the species is normally autoicous, and this was probably the case with the Tasmanian plant. (C. Müller, it may be mentioned, on the same page of Hedwigia describes *Astomum curvulum* also as dioicous, but Roth found it to be autoicous.) No ♂ flowers were to be seen on the specimen of *A. subexserens* which I received from C. Müller's herbarium, but the material was insufficient to base a conclusion upon in this respect.

I only know of this species in New Zealand from the Lyttelton Hills, Banks Peninsula, where it was gathered in 1892 by Beckett; and from Masterton Park, Mauriceville, Wairarapa, where it was gathered in 1910, and sent me by Mr. W. Gray. It is also found in Tasmania and Western Australia.

4. Pleuridium nervosum (Hook.) Par., Ind., p. 972.

Syn. *Phascum nervosum* Hook., Musc. Exot., t. 165. *Astomum nervosum* C. M. in Bot. Zeit., 1847, p. 98.

Var. minus Roth, Aussereuropäischen Laubm., 1, 160, t. xiv (Watts and Whitelegge, Census Musc. Australiens., p. 33—*nomen solum*).

Roth has pointed out some slight differences between the Australasian plant and the original Cape of Good Hope plant, *leg.* Menzies, described by Hooker—smaller papillose spores, $18-22\,\mu$, large ♂ flowers, &c.—which perhaps justify its being treated as a variety of that species rather than as the type form.

The comparatively tall, rigid, julaceous stems, and short, strict leaves with stout nerve, will separate it from all the other species except the following. It appears to be widely distributed in Australia, but from New Zealand I have only seen it from the original locality quoted in the Handbook—viz., "Bay of Islands, North Island, *Hooker* and *Colenso*." R. Brown (Trans. N.Z. Inst., vol. 26, p. 302) states that it is to be found in the same localities as *Phascum apiculatum*, but not so commonly, the localities he gives for *P. apiculatum* being "Port Hills and on the plains in the neighbourhood of Christchurch." The plant in Brown's herbarium under this name (*P. nervosum*) from Lyttelton Hills is, however, *P. gracilentum* Mitt., and it is probable that the plant referred to by him in the above passage really belonged there also.

This species has usually been cited as *Pleuridium nervosum* (Hook.) H. f. & W. (Fl. N.Z., 2, 58), but it is still retained there under *Phascum*, *Pleuridium* being only mentioned as a subgenus.

5. Pleuridium curvulum (C. M.) Par., Suppl. Ind., p. 277; Roth, Aussereuropäischen Laubm., p. 162, t. xvii.

Syn. *Astomum curvulum* C. M. in Hedw., 1898, p. 78 (nec *Phascum curvulum* Tayl.).

I have not seen this species, which was described by C. Müller from a specimen of Cheeseman's (in Herb. Levier) gathered at Penrose, near Auckland, in 1882. It must be very close to *P. nervosum* var. *minus*; but as Roth keeps the two apart, and gives some distinguishing characters, I have maintained it here. As far as can be gathered from the descriptions and figures, it differs from *P. nervosum* var. *minus* in the following way: The lowest leaves in that are ovate, with a distinct nerve; the mid-stem leaves ovate-lanceolate, with the nerve percurrent or excurrent in a stout point. In *P. curvulum* the lowest leaves are almost orbicular, obtuse, and nerveless, the middle ones ovate and subobtuse, and with the nerve ceasing above the middle; and the upper cells are more incrassate.

In *P. nervosum* (and presumably in *P. curvulum* also) the upper areolation is somewhat wider and more irregular, often rhomboid or subhexagonal, with more oblique end-walls, than in the earlier species.

EXCLUDED SPECIES.

Pleuridium lanceolatum (R. Br. ter.) Par., Ind., p. 972 (*Phascum lanceolatum* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 302), and *Pleuridium longifolium* (R. Br. ter.) Par., *loc. cit.* (*Phascum longifolium* R. Br. ter., *op. cit.*, p. 303), from Brown's specimens in his herbarium, both belong to *Astomum austro-crispum* (C. M.) Broth. The latter is a more robust plant with longer leaves, which may well take varietal rank, but it is not separable specifically from *A. austro-crispum*.

DITRICHUM Timm. (*Trichostomum* Brid. p.p., Handb. N.Z. Fl., p. 416).

KEY TO THE SPECIES (INCLUDING DISTICHIUM).

1. Upper cells elongate, linear 2
Upper cells quadrate or rounded, isodiametrical 5

2. Stems tall (2 in.), leaves somewhat distant, falcate-circinate, nerve broad, fruit unknown .. .. 7. *blindioides.*
Fruiting plants. Stems short, or, if tall, leaves not circinate 3

3. Capsule cylindric, straight or very slightly curved, lid very short, conical 6. *brevirostrum.*
Capsule inclined, more or less asymmetrical 4

4. Leaves longly subulate, flexuose, silky, base of leaf and nerve pale 4. *flexifolium.*
Leaves short, rather rigid, basal cells golden, nerve orange-red 5. *calcareum.*

5. Capsule elongate-cylindric, straight or curved, pale when ripe, not narrowed at mouth .. .. 1. *elongatum.*
Capsule elliptic or shortly cylindric, usually straight, slightly narrowed at mouth 6

6. Leaves distichous, capsule small, lid shortly conical .. *Distich. capillaceum.*
Leaves not distichous, capsule longer, lid acutely rostrate 7

7. Leaf-base oblong, abruptly contracted above; cells at shoulder minute, dense, opaque .. .. 3. *punctulatum.*
Leaf-base oval, more gradually narrowed above; cells at shoulder short but not dense and opaque .. .. 2. *strictum.*

The genus *Ditrichum* is a difficult one, not so much through any great variability in the plants themselves as because the specific differences are in many cases not of a very marked character. To aid the student in determining the species, I have—without attempting a full description in the case of the older species—added some notes on each which may prove of assistance.

To add to other difficulties, several of the Australasian species have been much misunderstood, as the synonymy indicates, and some of the problems have been somewhat difficult to unravel, and have seemed to require treating at some length.

The distinction between the two forms of capsule on which the two subgenera *Aschistodon* and *Euditrichum* have been partly founded is not by any means so well defined as one would desire. Thus *D. strictum*, while having the capsule erect and symmetrical, has the mouth generally very slightly narrowed, while small capsules of *D. flexifolium* may scarcely exhibit the contraction, marked enough as it is in the normal, well-developed forms. The subgenera *Aschistodon* and *Euditrichum*, indeed, seem difficult to maintain. They are defined by Brotherus thus:—

Aschistodon Mont. Capsule symmetric, cylindric. Peristome teeth short, undivided, hyaline.

Euditrichum Broth. Capsule mostly asymmetric, narrow at the mouth, at times symmetric. Peristome teeth long, divided to base, golden, reddish-yellow or reddish-brown, rarely hyaline above.

The characters of peristome and capsule form are, however, not correlated. Thus several of the species of *Euditrichum* have the capsule erect and symmetrical; while *D. punctulatum* Mitt. has the peristome of *Euditrichum*, though to place it under that subgenus would separate it from its nearest relations, *D. strictum* and *D. elongatum*. Again, the peristome of *D. elongatum* is of an intermediate character, the teeth being undivided, but brown in colour, not pale or hyaline. I have, therefore, not retained the subdivision here.

1. **Ditrichum elongatum** (H. f. & W.) Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 51. [Plate V, fig. 3.]

Syn. *Trichostomum elongatum* H. f. & W., Fl. Tasman., 2, 176, t. 173 (1860), and Handb. N.Z. Fl., p. 417. *Cynontodium elongatum* Mitt., M. Austro-amer., p. 43. *Leptotrichum elongatum* Jaeg., Adumbr., 1, 230.

Ditrichum elongatum, *D. strictum*, *D. punctulatum*, and *Distichium capillaceum* form a group of plants which with quite clearly marked differences in the fruiting characters manifest a remarkable similarity in vegetative morphology and structure. I have endeavoured to elucidate the characters of this perplexing group in describing *D. punctulatum* below.

The capsule, however, of *D. elongatum* shows considerable difference from all the other species. In *D. elongatum* it is pale or dull brown, not dark reddish-brown as in *D. strictum* and *D. punctulatum*; it is larger and longer, exactly cylindrical, not at all narrowed above, the mouth if anything, indeed, a little widened, with a dark thickened rim; the lid is distinctly stouter and the seta always markedly paler above than below. The peristome, also, is shorter, the teeth single or slightly connected here and there in pairs, and less highly papillose.

D. elongatum occurs in Chile, Australia, and Tasmania, as well as in New Zealand. I have it from both North and South Islands.

2. **Ditrichum strictum** Hampe in Linn., 1867, p. 181. [Plate V, fig. 4.]

Syn. *Lophiodon strictus* H. f. & W. in Lond. Journ. Bot., 1844, p. 543, and Fl. Antarct., 1, 130, t. lix. *Leptotrichum australe* Mitt. in Journ. Linn. Soc. (Bot.), 1859, p. 66. *Trichostomum australe* H. f. & W., Fl. Tasman., 2, 177, and Handb. N.Z. Fl., p. 417. *Ditrichum australe* Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 51. *Cynontodium australe* Mitt., M. Austro-amer., p. 42. *Didymodon longifolius* H. f. & W., Fl. Antarct., 2, 408.

The confusion between this plant, *Ditrichum punctulatum* Mitt., and *Distichium capillaceum* has been very great, and it is by no means certain that the above references—given in Paris's Index—apply, so far as they refer to New Zealand plants, to *D. strictum*; it is quite possible that some of them should be transferred, at any rate *pro parte*, to *D. punctulatum*, under which species I have endeavoured to point out the distinguishing characters.

I have not seen any actual New Zealand specimens of the true *D. strictum*. None appear to exist in Hooker's herbarium at Kew. It might be assumed that those records for New Zealand in the Handbook which Mitten does not cite for *D. punctulatum* when later he separates that species and describes it are by implication retained under *D. australe*—i.e., *D. strictum*. These are, North Island, mountainous districts, Colenso; and Wairarapa Valley, Knight. But it is possible that Mitten had not seen these, or was not able to examine them at the time of publishing his *D. punctulatum*, and it is better to consider them, in the absence of specimens, as dubious. On the other hand, the records from Lord Auckland Islands and Campbell Island belong undoubtedly to the true *D. strictum*.

D. strictum has a wide distribution, being found on Chimborazo, in Fuegia, throughout most of the subantarctic islands, and in Tasmania, although it is probable that not all the Tasmanian records belong to the true *D. strictum*.

3. **Ditrichum punctulatum** Mitt., Botany of Kerguelen I., Musci, in Phil. Trans. Roy. Soc., vol. 168 (extra vol.), 1879, p. 25. [Plate V, fig. 5.]

Syn. *Distichium capillaceum*, Fl. N.Z., 2, 73 (non Bry. Eur., nec Handb. N.Z. Fl., p. 422). *Trichostomum filiformifolium* R. Br. ter. in Trans. N.Z. Inst., vol. 29, 482, tt. xxxix, xl. *Ditrichum filiformifolium* Broth. in Engler and Prantl. Pflanzenfamil., Musci, 1, 300.

Much of what has passed for *D. strictum* (*D. australe*) in New Zealand belongs to this plant. It was confused first with *Distich. capillaceum*, then with *D. strictum*, and although Mitten very clearly described and emphasized its true characters and distinctions in the Roy. Soc. volume cited, *D. punctulatum* has remained a little known and little understood species. Even in Mitten's herbarium there is no specimen so named, the plant referred by him to the species in his original description—viz., "New Zealand, coll. Dr. Lyall"—the type of *D. punctulatum*, being retained under *D. Hookeri* (C. M.) Hampe, marked "*Lophiodon strictus* H. f. & W.," with the note, "This is *Distichium capillaceum* var. in Fl. New Zealand." It is not referred to anywhere, I believe, in the various articles on New Zealand bryology that have appeared from time to time in the pages of the Transactions; and Brotherus refers to it as a species which he has not seen. Mitten's note on his new species is worth quoting: "In size, colour, and general appearance very similar to *D. australe*, having also the same, but narrower, flattened apices to its leaves; in the recurvation of the subulate portion from the top of the erect base it resembles *D. capillaceum*, and for this species Dr. Lyall's barren specimens were mistaken, although the leaves are not distichous, but so disposed that each fifth leaf occupies the same vertical position on the stem as the first counted from; the outline of the dilated base is not oval-elliptic as in *D. australe*, but oblong-obtuse. The fruit in an old state is present on Dr. Haast's specimens; accompanying these fertile stems were many conspicuous male flowers, which do not appear to arise from the lower parts of fertile stems, but seem to be really distinct male plants."

Fruit in good condition has not hitherto been described, but I am in possession of good fruiting specimens with just mature capsules gathered and sent me by Mr. W. Gray from Mauriceville, from which the drawings have been made which accompany this description.

As mentioned above, the leaves of *Distichium capillaceum*, *Ditrichum elongatum*, *D. strictum* and *D. punctulatum* very closely resemble one another, and great care is needed to separate the species, especially in the absence of fruit. The inflorescence in *Distich. capillaceum* is paroicous; in *Ditrichum strictum* and *D. elongatum*, autoicous; in *D. punctulatum* it appears to be truly dioicous, as described by Mitten; Mr. Gray's plants show numerous stems, bearing terminal male flowers, about ¾ in. or 1 in. in height, and certainly entirely separate, not connected with the fertile stems.

Distichium capillaceum is known by its truly distichous leaves, in which the subula is usually papillose, but only slightly denticulate towards apex. The capsule is very small, and varies little in form; it is elliptical, usually (without the lid) about 1·5 mm. long, but ranging from 1 mm. to 2 mm., not perceptibly narrowed to the mouth, erect and symmetrical or very slightly gibbous. The lid offers the best means of distinction from the similar species of *Ditrichum*; this is very short, scarcely more than one-fourth the length of the capsule, conical or very shortly and not acutely rostellate, the short beak being often curved and somewhat eccentrically placed. The peristome teeth are short, inserted far below the capsule-mouth, split into two often unequal halves which are more or less cohesive, vertically or obliquely striolate, but otherwise quite smooth. Spores 17–20 μ.

Ditrichum elongatum when in fruit is readily known, as described under that species. The leaves are in no way distichous, and are usually more closely set than in *D. punctulatum*, never, I think, so distant as is usual in that species; otherwise I am unable to detect any difference in the leaf-structure. The colour appears to be usually a dull or yellowish green.

D. strictum has the leaves closely set also, but they are much more rigid than in *D. elongatum*, and usually very dark in colour, sometimes almost black. The leaf-base tapers much more gradually into the subula than in *D. punctulatum* and *D. elongatum*, and does not show the abrupt shoulder of those species, and the cells of the upper part of the sheathing base, though short, are rarely isodiametric, usually elongate rhomboid, and more or less clear and pellucid, not forming the group of dense, obscure cells of the shoulder found in those two species. The subula appears to be normally (probably constantly) smooth, not scabrous, and a very frequent feature is the apex, which is often continued equally wide to the extreme tip, where it is flattened out so as even to appear slightly spathulate; this wide obtuse apex being often markedly though not sharply denticulate.

The capsule in *D. strictum* is small, 1 mm. to 1·25 mm. long, rarely 1·5 mm. (without lid), on a stout seta. It is pachydermatous, widely elliptical, with a narrowed mouth; the lid in the only operculate capsule I have found in Hooker's herbarium is longly and finely subulate, the straight erect beak being about as long as the capsule itself. A specimen of "*Leptotrichum australe* Mitt., Tasmania, Archer" in Herb. Kew., which Mitten by implication retains under *D. strictum* (not *D. punctulatum*), varies somewhat in the form of leaf-base, but has the tapering shoulder and the upper cells of *D. strictum*; this shows a decidedly longer and narrower capsule than the type of *D. strictum*, having capsules fully 2 mm. long, on stout setae.

D. punctulatum is a much more slender, flexuose plant than *D. strictum*, pale green above when fresh, with stems more than an inch in height. The leaves are normally and almost constantly distant, so that the greater part of the sheathing base is exposed, and this gives a slender, very marked and characteristic appearance to the stems, very similar to what is seen in attenuated and elongated stems of *Distich. capillaceum*, where, however, the leaves are truly distichous, while here they are inconspicuously 5-ranked. The leaf subula also is more flexuose and slender than in *D. strictum*. The lax disposition of the leaves will usually separate this species from *D. elongatum*, with which, however, in structure they are practically identical. The long sheathing base, enrolled at margin, has generally a narrowly oblong form, and is often very long; it contracts abruptly at the shoulder into the subula, and here the elongate basal cells pass rapidly into a group of minute rounded or transversely elliptical rather obscure cells, which give a very characteristic opacity to the shoulder of the leaf. The subula is very long and fine, smooth or scabrous, flexuose, usually acute, and, as a rule, marked by several very strong and acute spinulose teeth in the upper part.

The seta is bright red below, pale above, 1 cm. to 1·75 cm. in length, and rather slender. The capsule is 2-3 mm. in length, rather leptodermatous, pale when young, when ripe of a dull, not reddish brown; it is erect and symmetrical or very slightly curved, of a narrowly elliptic form, usually widest at a point about one-third of its height, and from there gradually tapering to the mouth, the tapering being continued along the very acute rostrate lid, which is about half the capsule-length. The spores are very small, 8-10 μ. The peristome shows a remarkable combination of the characters of *Ditrichum* and *Distichium*. In the former genus they are normally inserted at, not below, the orifice, are highly papillose, and are not marked by vertical or zigzag striations. In *Distichium*, as mentioned above, they are striolate, but otherwise smooth, and inserted much below the rim of the capsule. In *D. punctulatum* they are inserted below the orifice as in *Distichium*, but are highly and densely papillose, without striae, of a distinctly brown tint.

Examination of the type of *Trichostomum filiformifolium* in R. Brown's herbarium shows that it belongs to *D. punctulatum*.

It is rather strange that Mitten has not kept up *D. punctulatum* in his own herbarium. As mentioned above, the type specimen is there placed under *D. Hookeri* (C. M.) Hampe (*Leptotrichum Hookeri* C. M.). This determination must have been made very hurriedly by Mitten. I have compared his plant with the original specimens of *Leptotrichum Hookeri* (*Didymodon longifolius* H. f. & W.) in Herb. Hooker,—viz., "Tierra del Fuego, 1833, C. Darwin"; and "Hermite I., Hook., No. 132"—and they are absolutely distinct. *D. Hookeri* has the leaves tapering above, not abruptly contracted to the subula, and is entirely without the cells, at that portion of the leaf, characteristic of *D. punctulatum*; the lid of the capsule is blunter, and there are other differences. *D. punctulatum* Mitt. is a perfectly good species, much more closely allied to *D. strictum* than to *D. Hookeri*.

In all probability *D. punctulatum* is widely distributed in New Zealand, but its range is at present obscured through its confusion with other species. It will perhaps be as well to give the records known to me at the present time. Those cited by Mitten are: New Zealand, *Dr. Lyall*; Great Barrier Island, *Hutton* and *Kirk*; *Fagus* forests, *Hopkins*, *Dr. Haast*. I have it in my herbarium from Mauriceville, Wairarapa, North Island, *leg.* W. Gray (two or three stations), and from Kelso, Otago, South Island, *leg.* D. Petrie. I do not know of any record or specimen from outside the New Zealand region, but in all probability it will be found to occur at least in Tasmania, either at present undetected or recorded under one of the other names.

4. Ditrichum flexifolium (Hook.) Hampe in Flora, 1867, p. 182.

Syn. *Dicranum flexifolium* Hook., Musc. Exot., t. 144 (1820) [non *Dicranum flexifolium* Hornsch. in Schwaegr., Suppl., 2, 115 (1826)]. *Trichostomum laxifolium* H. f. & W., Fl. N.Z., 2, 72; Handb. N.Z. Fl., p. 417. *Ditrichum laxifolium* Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 51. *Leptotrichum affine* C. M. in Bot. Zeit., 1847, p. 825. *Cynontodium affine* Mitt., M. Austro-amer., p. 42. *Ditrichum affine* Hampe, *op. cit.* *Trichostomum setosum* H. f. & W., Fl. N.Z., 2, 73, t. 84; Handb. N.Z. Fl., p. 417. *Leptotrichum capense* C. M., Syn., 1, 453. *Ditrichum capense* Par., Ind., p. 392. *Leptotrichum plicatum* C. M., Syn., 1, 446. *Didymodon plicatus* Mont., Syll., p. 49. *D. cirrifolius* Mont. in Ann. Sci. Nat., 1842. *Ditrichum plicatum* Hampe in Nuov. Giorn. bot. ital., 1872, p. 273. *Leptotrichum Boryanum* C. M., Syn., 1, p. 452. *Ditrichum Boryanum* Hampe in Fl., *loc. cit.* *Trichostomum difficile* Duby in Moritzi, Verz. d. Zoll. Pfl., p. 134. *Ditrichum difficile* Fleisch., Die Musci der Fl. von Buitenzorg, 1, 300.

It is with considerable diffidence that I have united the two plants usually known as *D. affine* (*Trichostomum setosum* of the Handbook) and *D. laxifolium*. Such hesitation, however, as I have in so doing arises not from any doubt remaining in my own mind as to their identity, but from the fact that, so far as I am aware, though the plants exist in many herbaria under both names, and have been treated in several works, no suggestion, so far as I know, has been hitherto made as to any close relationship between them. I do not even recollect seeing the two compared with one another —*e.g.*, in such works as the Handbook. And yet a comparison of the respective descriptions at once suggests their close resemblance, and, indeed, fails to disengage any character of even second rate importance to separate them.

The distinguishing characters as given in the Handbook amount to the following:—

D. affine.	*D. laxifolium.*
Leaves, strict, erect, crowded. Fruit-stalk pale.	Leaves distant, spreading, flexuose, very long. Fruitstalk red.

All the other characters given are absolutely identical.

The seta is usually pale, often quite yellow up to the time of maturing of the fruit; it varies to red, and often or usually becomes darker after maturity; but there is no correlation between the colour of the seta and the leaf-characters given above. Thus some of the most extreme "*laxifolium*" plants I have in my herbarium show the seta pale-straw-coloured throughout. A very instructive specimen in R. Brown's herbarium—"*D. laxifolium*, Kelly's Range, Westland, ex herb. Beckett"—is of the most pronounced "*laxifolium*" type, with very long, lax, widely spreading leaves, a very elongate seta, up to 4 cm. in length, and a proportionately long, much-curved capsule; this has the setae of all shades from pale straw-colour, at least in the greater part, to a bright red, although all the capsules are in a similar stage of maturity (just ripe), and a few deoperculate. The colour of the setae may be eliminated, therefore, and there remain only the leaf-characters given above, which might quite well apply simply to two forms—a denser and a laxer one—within the limits of a single species, even were there not intergrading forms between them. As a matter of fact, these intergrading forms are present, and frequent, and I have several specimens as to which I should be very hard put to it if required to decide to which of the two they should be attributed. The species, in fact, exhibits a great degree of variation as regards height and density. The stems may be very short, less than 0·5 cm. in height, or they may reach to 4 cm.; while the seta varies from 1 cm. or less to 4 cm., and the capsule from barely 1 mm. to fully 5 mm. in length.

The species is an easily recognized one from the yellowish or bright-green silky foliage, the pale-yellow seta, and the bright orange-brown capsule, curved or gibbous, and distinctly tapering to the mouth when well developed.

The specific name here adopted will probably be somewhat unfamiliar, and it will be necessary to go at some detail into the history of the plant to explain the position. Hooker, in the "Musci Exotici," described clearly and with some fulness, and figured very accurately on tab. cxliv, a plant from the Cape of Good Hope, collected in 1791 by Menzies, under the name of *Dicranum flexifolium*, the peristome and calyptra having then not been seen. It is clearly a species of *Ditrichum*, and it seems unaccountable that C. Müller (Syn., 1, 651) should, in the absence no doubt of specimens, have queried it as a synonym of *Weisia viridula* Brid.

In the "Flora of New Zealand," 2, 72, it is fully recognized that the plant there described as *Trichostomum laxifolium* is identical with Hooker's South African plant. The authors write, "Found at the Cape of Good Hope." They give *Dicranum flexifolium* Hook. as a synonym, and add that a change of the specific name is requisite, to avoid confusion with the *Dicranum flexifolium* Hornsch. of Schwaegrichen. This latter, however, which is a *Campylopus*, dates from six years later than Hooker's publication, and could in no case exclude the retention of Hooker's name.

To set at rest any doubt as to the identity of the two, I have examined Hooker's type at Kew, "H. 981, Cape of Good Hope, Menzies, 1791." There are (on that sheet) only three capsules in good condition; of these, two are erect and equal at mouth, the third is slightly inclined and very slightly narrowed at the orifice. The setae are 6 mm., 7 mm., and 10 mm. long. The plants agree in every respect with the smaller forms of *D. laxifolium* (and *D. affine*) from Australia and New Zealand, with the only possible exception of the shortness of seta and the form of the capsule; but the smaller forms of the Australian plants vary greatly in this direction; and I have numerous plants which for shortness of seta and form of capsule are exactly identical with Hooker's specimens. Moreover, on the same sheet of Hooker's herbarium there are other specimens—"H. 3072, *prope* Cape Town, Mund"—with the longer seta and oblique narrow-mouthed capsules exactly characteristic of the normal Australasian plant. There can, in fact, be not the slightest doubt as to the identity of the latter with Hooker's *D. flexifolium*, and Hampe was certainly right in restoring the specific name.

C. Müller, as has been mentioned, failed to recognize the affinity of Hooker's species, and in consequence described the South African plant as new under the name of *Leptotrichum capense* (Syn., 1, 453), based on specimens from Table Mountain, *leg.* Ecklon, and Port Natal, *leg.* Gueinzius. There is a long series of *D. capense* at Kew, including Gueinzius' plant, and I have been able to satisfy myself not only that it is exactly identical with Hooker's *D. flexifolium*, but that the South African plant presents all the variation which the Australasian plants exhibit, and which has given rise to the two supposed species *D. affine* and *D. laxifolium*. Rehmann's specimens particularly indicate this (*cf.* Rehm., M. Austr.-afric., 84*b* and 84*c*). C. Müller compares his plant with his *Lept. affine* (then only known from Chile), giving as differences the flexuose, acute leaves, shorter seta, small cernuous capsule, and short peristome teeth: he describes the leaves of *L. affine* as "obtusiuscula," a description with which few, I think, will agree. I have measured setae in a plant of Gueinzius' (probably the identical gathering described by C. Müller, though in this case the locality is simply described as "Cap") varying from 5 mm. to 13 mm. on the same tuft, while in other specimens they show all the range of the Australasian plant: the capsules are absolutely identical in form, and the peristome, if possibly a little shorter in general is not constantly so, and may be actually identical. Gueinzius' Port Natal plant in herb. Schimp. is quite identical with Hooker's *D. flexifolium*, and, so far as can be examined, with the Australasian plant, but the capsules are too young to show peristome.

I have examined numerous specimens of the South Indian *Ditrichum plicatum* (Mont.) Hampe, including Montagne's plant from the Neilgherries, and find them identical with the Cape *D. flexifolium*, and showing the same range of variation. I have not been able to examine the actual types of the Javan plant—*D. difficile* (Duby) Fleisch.—nor of the Bourbon *D. Boryanum* (C. M.) Hampe—but I do not feel the least doubt that they are both referable to the same very widespread type.* *D. amoenum* Thw. & Mitt., from Ceylon, has a very imperfect almost rudimentary peristome, and may perhaps at least provisionally be kept separate.

5. **Ditrichum calcareum** (R. Br. ter.) Broth. in Engler and Prantl, Pflanzenfamil., Musci, 1, 300 (1901). [Plate V, fig. 7.]

Syn. *Trichostomum calcareum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 480, t. xxxix. *Leptotrichum subbrachycarpum* C. M. in Hedw., 1898, p. 111. *Ditrichum subbrachycarpum* Par., Suppl. Ind., p. 132.

D. calcareum is a plant of markedly dense habit, with short leaves little altered when dry and closely imbricated, scarcely secund; rather abruptly narrowed from the base to the subula. The nerve is very broad and thick, as much as 100 μ or 120 μ wide at the base, sometimes ill defined at the sides, of a deep orange-red, giving with the bright yellow of the basal cells a very striking coloration to the leaves; the basal areolation is very narrow linear. In *D. brevirostrum* the leaves are smaller, more gradually narrowed to the subula, with narrower, thinner, less highly coloured nerve, and somewhat wider basal areolation.

I have examined the type of *Leptotrichum subbrachycarpum* C. M., from the Grampians, Victoria, *leg.* Sullivan, in herb. C. Müller, and find it quite identical with R. Brown's plant, so far as the vegetative characters go. I have not seen the fruit of C. Müller's species, but the description agrees exactly with the description and figure of R. Brown's plant, except that C. Müller describes the theca as erect, while *D. calcareum* is described and figured as inclined. The exact similarity of the other characters, and especially of the marked vegetative features, leave no doubt, however, of the identity of the two. The small tuft in R. Brown's herbarium possesses a single seta, but no capsule. The author describes and figures the peristome as considerably longer than in *D. brevirostrum*. The lid is equally short. The inflorescence is autoicous, with several gemmiform ♂ flowers below the perichaetium.

The locality given by R. Brown, "Castle Hill, West Coast Road," is, so far as I have any information, the only known New Zealand habitat.

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* I have dealt with the Indian plants more fully elsewhere: *cf.* Journ. Bot., vol. 50 (1912), p. 145.

6. **Ditrichum brevirostrum** (R. Br. ter.) Broth. in Engler and Prantl. Pflanzenfamil., Musci, 1, 300 (1901). [Plate V, fig. 8.]

> Syn. *Trichostomum brevirostrum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 481, t. xxxix. *Trich. radiculosum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 480, t. xxxix, p.p. *Ditrichum radiculosum* Broth. in Engler and Prantl, Musci, 1, 300.

R. Brown does not describe the inflorescence of this species. It is, I think, almost certainly dioicous. I have not seen the male inflorescence, but I have examined two or three fruiting-stems without finding any trace of a ♂ flower, and have dissected one which certainly had no antheridia proximal to the perichaetium, so that I am assured it is neither autoicous nor paroicous.

The capsule is erect and almost symmetrical, at most very minutely curved—I should scarcely call it "slightly oblique," as R. Brown describes it—narrowly cylindrical, 1·5–2 mm. long, 0·25 mm. wide, the lid very short indeed and conical. The seta is pale red below, yellowish at summit, and varies in the single tuft from 1 cm. to 2 cm. in length. The annulus is more or less persistent and very broad, almost half the height of the very short, filiform peristome teeth, which are scarcely $100\,\mu$ in length, somewhat irregularly coherent, and minutely papillose. I have not been able to measure the spores.

The leaves are small, about 2 mm. in length, strongly falcate-secund, entire, the upper cells narrow-linear, the nerve rather stout and reddish below, filling the greater part of the subula, and excurrent. The leaves are in form and structure very similar to those of *D. calcareum*, but strongly falcate and with narrower nerve. The stems, too, are loosely gregarious, and much shorter than in that species, and scarcely branched, while in that they are much branched, tall and densely caespitose. *D. flexifolium* is known at once by the flexuose, silky leaves, the paler seta, and differently shaped capsule and lid.

D. brevirostrum has not been found, I believe, since its discovery by R. Brown, near Lake Te Anau, in 1890.

INCERTAE SEDIS.

7. **Ditrichum blindioides** Broth. in Oefv. af Finska Vet.-Soc. Foerh., 55, 76 (1898). [Plate V, fig. 9.]

> Syn. *Dicranum subangustifolium* C. M., MS. in Herb. et Gen. Musc. Fr., p. 291 (*nomen*).

The type of C. Müller's *D. subangustifolium*, "Tokatoa, Auckland, N.Z., Nov., 1881, *leg.* G. Zürn," agrees in every respect with Petrie's original of *D. blindioides* (Thames, Auckland, July, 1896, No. 712 in herb. Beckett), except that the areolation is a little denser than in most of the leaves of the latter plant; some of the better-developed leaves are identical in the two. The areolation in Petrie's plant, indeed, varies considerably as between leaves of the same stem, and this suggests a somewhat abnormal, more or less aquatic or hygromorphose form.

The generic position must, as Brotherus says, remain somewhat uncertain in the absence of fruit. I am inclined myself to think it referable to *Dicranella*; the tendency to a widening of the cells under conditions of moisture is a well-known one in *Dicranella*, but I have not met with it in *Ditrichum*. C. Müller's classification of it under *Dicranum* (*Scopellae* *falcatae*), with *D. falcatum*, *Starkii* and *Blyttii*, is quite untenable. There are no enlarged alar cells, and the falcate-circinate leaves are really all that the plant has in common with those species.

Among the New Zealand species of *Ditrichum* the habit is quite peculiar, and the plant easily recognizable. It is, so far as is at present known, confined to Auckland.

EXCLUDED SPECIES.

Ditrichum falcatum (R. Br. ter. as *Trichostomum*) Broth. is a *Dicranum*.

D. Hallii (R. Br. ter. as *Trichostomum*) Broth. is *Dicranum trichopodum* Mitt.

D. Moretonii (R. Br. ter. as *Trichostomum*) Broth. is *Holomitrium perichaetiale* (Hook.) Brid.

D. radiculosum (R. Br. ter. as *Trichostomum*) Broth. is a "composite" species: the sterile tuft in Brown's herbarium is *D. brevirostrum* (R. Br. ter.) Broth.; a single fruiting stem belongs to something apparently quite different but altogether indeterminable. The time and place of collecting were, it will be noted, exactly the same as for *D. brevirostrum*.

D. avonense (R. Br. ter. as *Trichostomum*) Broth. belongs to *Pottiaceae*.

I have examined the types of all the above in R. Brown's herbarium.

Ditrichum scabrifolium (Mitt.) Broth. is not recorded from New Zealand, but a note on it may be serviceable. Brotherus refers to it (Musci, 1, p. 300) thus: "Die Beschreibungen von *D. scabrifolium* Mitt. (Tasmanien) und *D. punctulatum* Mitt. (Neuseeland) sind mir unbekannt geblieben." Watts and Whitelegge (Cens. Musc. Australiens. p. 36) give "*Ditrichum scabrifolium* Mitt., Catal. of Austral. Mosses, in Proc. Roy. Soc. Vict., 1882-83. Tas.: Archer, Oldfield, Bastow." I have examined Mitten's specimens at Kew, with the following results: "*Leptotrichum scabrifolium* Archer et M., copse near West End rivulet, Tasmania, Mr. Archer," Mitten in sched., is *Ditrichum flexifolium*—the "*laxifolium*" form. "*L. scabrifolium*, ditches, Tasmania, Mr. Archer, 23 Aug.," Mitten in sched., is *Ditrichum elongatum* (H. f. & W.). The other specimens so named in Hooker's herbarium, "Van Diemen's Land, Fraser, H. 2739 and H. 2741," are a mixture of *D. elongatum* and *D. flexifolium*. It would appear that it was *D. elongatum* which gave rise to Mitten's name *scabrifolium*, the identity with Hooker and Wilson's plant being perhaps partly masked by the admixture of *D. flexifolium*. I have seen no specimens of Oldfield's under that name, and I do not know the source of Bastow's record. It is not included in his "Tasmanian Mosses."

SAELANIA Lindb., Utkast not. grupp., p. 35 (1878).

Lindberg created this genus for a very marked plant, by many authors retained in the genus *Ditrichum*. It has a wide distribution in the Northern Hemisphere, but, so far as I am aware, its sole station in the Southern Hemisphere, so far discovered, is that on Mount Ida, Otago, whence it was collected by Petrie, determined by Brotherus, and recorded by Beckett in a paper in Trans. N.Z. Inst., vol. 31, p. 426. The specimen from Mount Ida sent me by Rev. C. H. Binstead ex herb. Beckett, which is in fruit, appears to agree exactly with our northern plant. As this species has not, I believe, been described in any work on New Zealand mosses, I give below a description, taken from my "Students' Handbook of British Mosses."

Saelania glaucescens (Hedw.) Broth. in Engler and Prantl. Musci. vol. 1. 300.

> Syn. *Trichostomum glaucescens* Hedw., Descr., 3. 91. t. 373; Bry. Eur., 2. t. 184. *Ditrichum glaucescens* Hampe in Fl. 1867, p. 182. *Saelania caesia* Lindb., Utkast, *loc. cit.*

In dense *glaucous bluish-green* tufts, brown below, ½ in. to 1 in. high. Stems erect, slender, much branched. Leaves *small*, broadly lanceolate below, larger and longer at the summit of the branches, forming a coma; erecto-patent, slightly twisting at the point, somewhat flexuose when dry; *acutely linear or linear-subulate from a lanceolate or oblong base*, margin *plane*, *bluntly serrate* above; nerve distinct, slightly excurrent in the longer leaves; cells all rectangular, at base empty, 4–6 times as long as broad, above *about twice as long as broad, or sometime quadrate*, chlorophyllose; in the lower leaves more uniform. Capsule *erect* on a short seta, oval-oblong, thin-walled, brown, irregularly plicate when dry and empty; annulus yellow, of two rows of cells; lid acutely conical; peristome conical, the teeth purple, the divisions much united above. Autoicous; male flowers gemmiform, on short branches below the perichaetia.

On earth in clefts of rocks in alpine districts.

This rare species will be recognized at once by the bluish-green colour from any other moss with which it is likely to be confused. The leaf-cells are longer and narrower than in *Ceratodon*.

Ceratodon Brid.

Ceratodon purpureus (L.) Brid. var. **xanthopus** Sull.

> Syn. Var. *flavisetus* Limpr. *Ceratodon convolutus* Reichdt. *C. delicatulus* C. M. and var. *minor* C. M.

* Subsp. **Ceratodon stenocarpus** Bry. Eur.

> Syn. *Ceratodon elimbatus* Broth. in Abhandl. L. Natur. Ver. in Bremen, 1900, p. 497. *C. corsicus* Bry. Eur.

The New Zealand forms of this cosmopolitan species appear to me most satisfactorily arranged under the above three heads. The type form at least is common in New Zealand.

I have examined the types of *C. convolutus* and *C. delicatulus*, and I can see nothing in them but varietal forms at most. The leaves manifest the usual variations in this species, and on both I have found the normal form with nerve just excurrent and the margin at apex dentate, side by side with entire leaves and more longly excurrent nerve. The characters drawn from the colour of the seta and from the form of apex of the perichaetial bracts are eminently unsatisfactory, showing apparently no correlation with other characters or with the geographical distribution of the plants, although the pale seta seems to be associated, as a rule, with warmer situations.

The form of peristome with the teeth unbordered or with a very narrow and indistinct border, less nodose, and divided to the basal membrane, is a character of somewhat more importance (although all degrees of transition are to be found between it and the typical *purpureus* peristome), and I have—somewhat against my own judgment—retained this series, to which the Chatham Island *C. elimbatus* Broth. belongs, although as a subspecies only. I entirely agree with Mrs. Britton ("North American Flora," vol. 15, p. 61), however, in uniting *C. corsicus* Bry. Eur. and *C. stenocarpus* Bry.

Eur., and have no hesitation in referring *C. elimbatus* to this subspecies, with which I think it agrees in every important respect. The capsule is perhaps less elongate and cylindrical than in the plant of India and similar regions, but in the European *C. corsicus* this character varies very considerably, as, indeed, it does in the Indian plants themselves.

There seems to be some confusion between *C. delicatulus* var. *minor* and *C. elimbatus* as regards origin. Brotherus, who published the descriptions of both *C. elimbatus* Broth. and *C. delicatulus* C. M. in "Musci Schauinslandiani," gives the distribution thus: *C. elimbatus*: Neuseeland—Otago, Blue Mountains (D. Petrie in herb. T. W. Naylor Beckett, sub n. 660); Glenorchy und Kinloch, Heide (Schauinsland, n. 192 und 203, f. seta longiore). *C. delicatulus*: Neuseeland—Chatham Islands (n. 32). Var. *minor*: Neuseeland—Rangitoto Island (n. 177, 251).

In C. Müller's herbarium the Glenorchy plant, Schauinsland, n. 203, is the type of *C. delicatulus* var. *minor*, and is the only specimen there so named. The Rangitoto Island n. 177 has in C. Müller's hand: "*Ceratodon delicatulus* n. sp. nunc; *C. Cookii* n. sp. olim"; and therefore appears to be the type of *C. delicatulus*. I do not understand how the confusion arose, or what is the solution; nor, frankly, does it appear to me a point worth taking the trouble to clear up.

CHEILOTHELA Lindb., Utkast not. grupp., p. 34 (1878).

This genus was segregated from *Ceratodon* by Lindberg for the European *Ceratodon chloropus* Brid., to which Brotherus has added the Chilian *C. chilense* Mont., and the New Zealand *C. novae-seelandiae* Broth. It is separated from *Ceratodon* by the capsule without struma, but especially by the character of the areolation, which in the upper part of the leaf is dense and obscure with bifid papillae.

Cheilothela novae-seelandiae Broth. in Oefv. af Finska Vet.-Soc. Foerh., 1898, p. 164.

Syn. *Ceratodon novae-seelandiae* Par., Suppl. Ind., p. 100.

This plant is known readily from *Ceratodon* by the yellowish tufts, with rather solid leaves, rigidly incurved when dry, the cylindrical (*Tortula*-like) capsules on yellow setae, and under the microscope easily by the dense, obscure, papillose upper cells. It is more likely to be mistaken for a Tortulaceous moss, but the dry capsule usually shows some signs of plication.

According to Brotherus, the moss mentioned on p. 418 of the Handbook, and referred by Hooker very doubtfully to *Trichostomum strictum* Bruch, probably belongs here.

It is widely distributed in New Zealand, and probably common.

DISTICHIUM Bry. Eur.

Distichium capillaceum (Sw.) Bry. Eur., 2, p. 4, t. 193. Handb. N.Z. Fl., p. 422 (nec Fl. N.Z., 2, 73). [Plate V, fig. 6.]

Syn. *Swartzia montana* Lindb. in Act. Soc. sc. Fenn., 10, 16, et mult. auct.

There is no necessity to give the full synonymy of this almost cosmopolitan species, the geographical distribution of which occupies eight lines in Paris, who, however, curiously omits New Zealand from the list, giving only Tasmania and Magellan for the Southern Hemisphere, although it occurs on Pichincha and Chimborazo, in several of the subantarctic islands, and in New Zealand. The plant originally recorded as this species in the Flora of New Zealand was not the true plant, and was later identified by Hooker and Wilson with *Ditrichum strictum* (*Trichost. australe* H. f. & W.). Even then, however, it had not found its true place, as the New Zealand specimens for the most part proved to belong to a distinct species, already described as *Ditrichum punctulatum* Mitt.

The true *Distichium* was, however, gathered by Sinclair and Haast in the Southern Alps, specimens of which are now in Hooker's herbarium at Kew. I have it, too, in my collection from Otago, and also from Westland, *leg.* D. Petrie. The truly distichous leaves in the best-developed stems give a very marked, flabellate and flattened appearance to the stems (*Phormium tenax* might be compared), and it cannot then be mistaken for any of the species of *Ditrichum*; but when the stems are drawn out and the leaves distant it may easily be confused with *D. punctulatum* Mitt.; though even then the leaves of the *Distichium* preserve their truly distichous arrangement.

The small, scarcely curved or quite symmetrical capsule, with very short, conical lid (conical-rostellate *when dry*), is also a good distinguishing character.

PSEUDODISTICHIUM Card., Not. prélim. in Rev. Bryol., 1905, p. 45, et Fl. Bryol. des Terres Magellaniqucs, &c., p. 208, t. v.

Sporophytic characters of *Distichium*. Leaves in 4–5 rows, not distichous; nerve strong and wide, in section showing numerous median deuter-cells, all the remaining cells homogeneous, stereid or substereid. Alar and basal marginal cells extremely narrow and thin-walled, forming a distinct hyaline border to the leaf-base.

In examining R. Brown's specimens of *Trichostomum* described in Trans. N.Z. Inst., vol. 29, p. 478, I felt some doubt about the true position of *T. Buchanani*. It is placed by Brotherus (who had not seen Brown's specimens) under *Ditrichum*, and its position seemed to be near that genus. Unfortunately, R. Brown's collection contained only a single tuft with two capsules, both old and scarcely admitting of close examination. I was struck, however, by the leaf-structure, the nerve being very broad, the upper cells short and slightly oblique or rhomboid, and the alar cells forming a very distinct group of thin-walled, hyaline cells which were carried as a gradually narrowing border for some distance up the base. The leaf, in fact, showed an almost exact resemblance to some forms of *Campylopus*, which was heightened by the leaf-apex being usually marked by three or four coarse, sharp denticulations.

A second plant of R. Brown's, ***Weissia Brotherusii***, showed—with a different capsule—very much the same type of leaf, but with the distinguishing characters still more strongly marked; and I had decided to create a new genus for the two species, and had, indeed, drawn up a description, when my attention was drawn to *Pseudodistichium* Cardot (*cf.* Brotherus, Musci. Suppl., pp. 1175–76, fig. 827), with which R. Brown's plants were certainly congeneric, and one, *Trich. Buchanani*, possibly identical. Having been able, through the kindness of M. Cardot, to examine a specimen of his *Ps. austro-georgicum*, I find that our plants indubitiably belong to the new genus, and the difference between the antarctic species and *Trich. Buchanani* R. Br., though slight, seems to require the latter being kept separate. *Ps. austro-georgicum*, as its name indicates, comes from South Georgia; a second species, or possibly a variety, has been collected, also by Skottsberg, in the Falkland Islands.

M. Cardot points out that the base of the leaf in *Distichium* often shows a border of narrow, thin-walled cells; but though this is frequently the case, it never, in my experience, shows any approach to the structure of *Pseudodistichium* described above: the border is paler, but usually coloured, and not hyaline; and is rendered much less distinct, in comparison with that of *Pseudodistichium*, by the fact that the internal basal cells are all highly elongate, while in the latter they are short—often very short—and therefore afford a far stronger contrast with the marginal ones.

The peristome as described and figured by Cardot has the teeth rather broad, divided nearly to the base into two unequal branches, which are, however, connected together here and there for the greater part of their length, and obliquely striolate throughout. The antheridia are elongate, as in *Distichium*.

KEY TO THE SPECIES.

Leaves sharply toothed, at extreme apex; upper cells isodiametrical, nerve 100–150 μ wide near base; capsule oblong, nearly erect .. .. 1. *Buchanani.*

Leaves entire or subentire; upper cells shortly rectangular or irregular, nerve 150–250 μ near base; capsule shortly and turgidly oval, inclined .. 2. *Brotherusii.*

1. Pseudodistichium Buchanani (R. Br. ter.) Dixon comb. nov. [Plate V, fig. 10.]

Syn. *Trichostomum Buchanani* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 482, t. xxxix (1897). *Ditrichum Buchanani* Broth. in Engler and Prantl, Musci, 1, 300.

The description given by R. Brown in the Trans. N.Z. Inst. may be supplemented by a few notes. The specimen in his herbarium contains only two old capsules, one narrowly oblong and slightly tapering to the mouth, as described and figured by him; the other slightly wider and more elliptical. No peristome is to be found, and it was not described by the author. The leaves are distinctly of two forms, all the leaves on some stems being gradually narrowed from above the basal part, and gradually convolute from very near the base, the subula being short and wide, with a more or less blunt apex, usually bearing two or three very sharp, subspinulose denticulations thus heightening the resemblance which the leaf as a whole bears to *Campylopus*. The leaves on other stems narrow very abruptly from a wide, subvaginant but not convolute base to a very narrow but not long tubular subula. The nerve in this form is somewhat narrower; the upper cells are dense and rather obscure, isodiametrical, subquadrate, with firm, somewhat incrassate walls. In the former type of leaf the upper cells are somewhat larger, 10–14 μ in diameter, quadrate or rhombic, empty, very distinct and pellucid, and are continued lower in the leaf than in the latter type, only the juxta-costal ones at the extreme base (apart from the hyaline border) being elongate and linear. (It may be remarked that in R. Brown's description of the areolation the terms "above" and "below" have been transposed by a slip.)

Ps. Buchanani differs from *Ps. austro-georgicum* Card. in the shorter, much less finely setaceous leaves, and in the capsule, which in that is strongly inclined, slightly curved and gibbous, thus closely resembling that of *Distichium inclinatum* Bry. Eur., while in *Ps. Buchanani* it is only very slightly inclined at most, elliptical, straight and slightly narrowed at mouth, almost resembling that of *Distich. capillaceum*.

This species has not, I believe, been gathered again since collected by R. Brown in the "old bed of River Waimakariri." It is much to be desired that this and the succeeding species should be rediscovered and further studied.

2. **Pseudodistichium Brotherusii** (R. Br. ter.) Dixon comb. nov. [Plate V, fig. 11.]

Syn. *Weissia Brotherusii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 441, tab. xxxviii.

When I first examined the type of *W. Brotherusii* in Brown's herbarium, and at once detected the close relationship between it and the foregoing plant, I supposed that I had to do with the same species, and that the difference in the form of capsule was accidental or varietal merely. Further examination, however, convinced me that I had to do with a distinct species. The type of *W. Brotherusii* in Brown's collection is a well-grown tuft with between 30 and 40 capsules, all of identical form and position, with no tendency to resemble those of *Ps. Buchanani*. Closer examination also showed that the leaves exhibited constant differences: the nerve very markedly wider, the cells of the expanded part of the leaf somewhat looser and more irregular, the upper distinctly different, not isodiametrical but shortly rectangular or elliptical, and the leaf-apex quite entire.

The seta is in several instances decidedly flexuose, although in others this is not marked; the capsules are inclined, very small, scarcely 1 mm. in length, turgidly elliptical, quite smooth, equal at base, and neither tapering into the seta nor strumose.

The capsule is somewhat leptodermatous, the exothecium cells elongate hexagonal, rather lax and scarcely incrassate, the rim thickened and dark reddish-brown, of two or three rows of short, more incrassate, deeply coloured cells. Stomata appear to be present at the extreme base of the capsule.

Ps. Brotherusii differs from *Ps. austro-georgicum* in the leaf-form as does *Ps. Buchanani*, in the longer upper cells, entire points, and the capsule, which is much smaller, shorter, oval rather than oblong, and symmetrical or almost so, not curved or gibbous.

SELIGERIA Bry. Eur.

A small genus of minute mosses, all the species with the exception of the single New Zealand representative being confined to the Northern Hemisphere, from the temperate to the arctic regions. The smallness of the plants has probably led to their being overlooked, and it is probable that further species will be detected in the subantarctic and antarctic regions.

Seligeria Cardotii R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 398, t. 41. [Plate VI, fig. 12.]

R. Brown described and figured the above species in the volume cited, from "Limestone rocks, Castle Hill, Mar., 1891; Weka Pass, limestone rocks, Mar., 1893; Oamaru, 1897. Coll. R. Brown." Curiously, Brown's herbarium contains no specimen under this name, but the plant exists there under the MS. name "*Blindia calcarea*," from "Castle Hill, West Coast Road; coll. R. Brown." The minuteness of the plant has baffled Brown's draughtsmanship, and the figures on tab. 41 are rather misleading: the leaves are much longer and finer than Brown has drawn them: they are, in fact, longly and finely setaceous from a very short lanceolate base; the subula is for the most part composed of the excurrent nerve, which may, however, have 1–2 rows of lamina cells at the margin; in the former case the subula is entire, in the latter it is finely crenulate with the projecting transverse walls. The basal cells are shortly and very narrowly rectangular, with moderately firm walls, all very pellucid. The inflorescence is autoicous, the ♂ flower being situated at the base of the fertile flower, and very small. The perichaetial bracts are longly subulate from much larger and longer subconvolute bases, and reach two-thirds or more of the length of the seta, which appears to be slightly curved when moist. The capsules in Brown's herbarium specimens are all deoperculate, and are turbinate and very wide at mouth. The exothecium cells are in the upper part very irregular, more or less isodiametrical, and highly incrassate; below they become larger, somewhat elongate (rectangular, &c.), and with proportionately at least thinner, somewhat sinuose walls. The spores are very minute, smooth. The peristome is very fragmentary, but the lower part of the teeth which remain are bright reddish-brown, moderately closely barred.

It is quite possible that this plant may have to be united with *S. acutifolia* var. *longiseta* Lindb., but at present it is best to keep it apart, in view of the possibility of the seta being normally curved. It would appear from R. Brown's description to be widely spread in the South Island, and further study should without much difficulty establish its true position.

I have figured the plant again from the specimens in Brown's herbarium.

BLINDIA Bry. Eur.

The genus *Blindia* is an especially interesting one for students of New Zealand bryology, as it is a distinctively austral genus, having its centre of distribution in the subantarctic regions of the Southern Hemisphere. Of thirty-five species listed by Brotherus thirty have their origin in these regions, some few of them extending to New Zealand, Tasmania, and northwards from Fuegia along the chain of the Andes; one of the remaining five is found in New Granada, the other four in Europe and Asia.

R. Brown (in Trans. N.Z. Inst., vol. 29, p. 452) in treating of the New Zealand *Dicrana*, expresses the difficulty he has found in delimiting the genera *Dicranum* and *Blindia*, "the differences between the two genera being so slight: the former having ovate to cylindrical capsules and the peristome united at the base, the latter having turbinate capsules, and in the peristome the teeth are free to the base." He adds that some mosses with ovate capsules have been put into *Blindia*, which leaves him in doubt as to the right genus in which to place several of his plants, many of which "touch closely on the borderland between the two genera." He therefore places them all, provisionally, under *Dicranum*.

In a letter to the Rev. C. H. Binstead, dated November, 1898, the late F. W. Naylor Beckett takes R. Brown somewhat severely to task for his want of critical acumen and his too great fondness for making new species, and mentions that he is unable to discriminate between *Blindia* and *Dicranum*, quoting the above sentence (as to the difference between the two being slight), with a note of exclamation to express his surprise. Well founded, however, as his criticism no doubt is as to some of Brown's methods and want of critical acumen, I cannot think that this particular criticism is well deserved, and I doubt whether Beckett himself would have found it a simple matter, at that date, to give a diagnosis which would clearly define the limits of the two genera.

For one thing, we have to bear in mind that C. Müller, by whom a considerable number of New Zealand mosses have been named, uses the generic name *Blindia* with quite a different connotation from that which its authors, followed by most recent writers, intended, as he includes in it not only *Stylostegium*, but also several of the species usually referred to *Dicranoweisia* (*e.g.*, *D. compacta* Schimp., *D. antarctica* Par., &c.).

The fact, too, that the capsule, while usually short, rounded, and wide-mouthed or turbinate after the fall of the lid, may be oval or even narrowly cylindrical, and may be either fully immersed or longly exserted, the seta either straight or arcuate, makes it very difficult to define the genus clearly. There is, however, generally a somewhat distinct habit and texture which will distinguish the species: the leaves are usually subulate, rigid, altering little when dry, the colour ranging from golden brown to an intense black, with scarcely any trace of chlorophyll in the leaves; the plants have a strong preference for wet or dripping rocks, and are rarely found in any other habitats; the capsule is in the large majority of cases short, rounded and wide-mouthed, and pachydermatous; the peristome teeth broad, short, deep red, and smooth.

These characters, however, are not invariable, neither do they lend themselves to exact expression in a diagnosis, and it is principally on anatomical and detailed structure that a scientific generic character must be based. This is principally to be found in the structure of the nerve, which in section is composed of nearly homogeneous cells, without clearly defined deuter; and of the peristome teeth, which are comparatively broad, flat, and short, entire or scarcely divided, and usually smooth without papillae or striolae. The alar cells also are differentiated, usually very markedly; the upper cells always smooth, generally linear, and usually more or less incrassate.

It will be seen that the following arrangement involves a considerable reduction of species, and a further drastic reduction will probably have to be made in the genus, many new species having been created without full allowance being made for the wide distribution possible of any given species through the subantarctic regions. Correspondence on the subject with M. Cardot has led to certain conclusions which I have incorporated in the synonymy of the New Zealand plants; and, in addition to these, M. Cardot informs me that the following reductions are also necessary:—

Blindia leptotrichocarpa C. M. (Fuegia) = *Ditrichum Hookeri* (C. M.) Hampe.

B. auriculata C. M. (Fuegia) = *Dicranum inerme* Mitt.

B. humilis C. M. (Chile, Fuegia) = *Dicranum pumilum* Mitt.

B. churuccana Besch. (Magellan) = *Dicranum pumilum* Mitt.

B. pulvinata C. M. (Kerguelen Island), probably = *Ditrichum conicum* (Mont.) Par.

Key to the Species.

1. Plants very slender, usually under an inch in height; seta arcuate when moist .. .. 3. *magellanica.*
Plants taller, rarely less than an inch; seta straight or flexuose 2

2. Capsule immersed; upper cells minute, oval, 1½ or 2 × 1 .. 2. *contecta.*
Capsule exserted; upper cells very long and narrow .. .. 1. *tenuifolia*

1. **Blindia tenuifolia** (H. f. & W.) Mitt., M. Austr.-amer., p. 59; Beckett in Trans. N.Z. Inst., vol. 27, p. 403, t. xxviii. [Plate VI, fig. 13.]

Syn. *Dicranum tenuifolium* H. f. & W. in Lond. Journ. of Bot., 1844, p. 512; Fl. Antart., 2, 407, t. 152. *Blindia robusta* Hampe in Linn., 1859–60, p. 627. *B. aquatilis* C. M. MS. in herb., et Gen. Musc. Fr., p. 245 (*nomen*). *B. Wellingtonii* C. M. MS. in herb., *et op. et loc. cit.* (*nomen*). *Dicranum rupestre* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 459, t. xxxi. *D. collinum* R. Br. ter., *op. cit.*, p. 460, t. xxxii. *D. circinatum* R. Br. ter. MS. in herb. *D. Walkeri* R. Br. ter. MS. in herb. *Blindia pseudo-robusta* Dus., Beitr. zur Bryol. Magell. &c., in Arkiv för Bot., bd. 4, p. 9, t. iii.

It may perhaps excite some surprise to find *B. robusta* cited as a synonym of *B. tenuifolia*. The history of the moss in New Zealand is as follows: On page 297 of Trans. N.Z. Inst., vol. 25, Beckett has an article on new species of New Zealand *Musci*, in which he describes *B. robusta* Hampe, quoting Hampe's description from Linnaea, based upon F. Müller's Australian specimens from Mount Munyang, alt. 6,000 ft., and adding: "*Hab.* On old moraine at base of Waimakariri Glacier, 1889, R. Brown. I have authentic specimens of *B. robusta* from Mr. Sullivan collected in snowy watercourses, Mount Kosciusko, N.S.W., which enabled me to identify this moss."

In his paper on *Dicrana* (Trans., N.Z. Inst., vol. 29, p. 451) R. Brown refers to this publication, stating that Beckett is in error as to the identification. The Waimakariri plant is, he says, the "*Dicranum rupestre* (? *Blindia*) of this paper," and he points out several characters (mostly of comparative magnitude rather than structural) distinguishing it from *B. robusta*, concluding: "but, above all, *B. robusta* is a monoecious plant, having the male inflorescence on separate branches, and its habitat in swampy ground, while *D. rupestre* is dioecious, and has its habitat on rocks." On p. 459 he describes *D. rupestre*, giving as its habitat, "On rocks, old moraine near Waimakariri glaciers. Collected by R. B.; February, 1889."

In R. Brown's herbarium there is no specimen under the name of *D. rupestre*, but there is a specimen labelled, in Brown's hand, "*Dicranum circinatum* R. Brown, co-type; Waimakariri Glacier; coll. R. Brown, Feb., 1889." *D. circinatum* was never published under that name, and there is not the slightest doubt that the specimen represents the actual plant published as *D. rupestre*, with the description and figures of which it agrees quite well. (In all probability Brown altered the name in view of Beckett's identification, in order to mark the difference in habitat of his moss from *B. tenuifolia*.)

The specimen consists of a well-grown tuft, about 2 in. high, repeatedly branched from the base. It agrees in practically every detail, so far as it admits of examination, with F. Müller's original specimens of *B. robusta* from Mount Munyang. The specimen scarcely admits of dissection to show the position of the male inflorescence, but I have little doubt it is monoicous. I have, indeed, found what I believe to be an old ♂ flower as a short lateral branch on a main stem; but the specimen is so repeatedly branched, and the branches so interwoven, and towards the base intermixed with sandy detritus, that it would be next to impossible to determine whether an apparently basal stem were a separate growth or a basal branch, and I have not the least doubt that Brown was misled in his interpretation of what he observed in this connection.

As regards habitat, *B. tenuifolia* is found on wet rocks and in the bed of watercourses and pools at high altitudes and under glacial conditions, frequently, no doubt, lying under patches of snow, and the purely rupestral or terrestrial habit can scarcely be looked upon as a specific difference. The other characters mentioned by Brown are in a variable plant like *B. tenuifolia* of quite minor importance. The specimen of *D. circinatum* in Brown's herbarium is, in any case, identical with some of the Australian specimens of *B. robusta*.

In the subsequent paragraph of his paper R. Brown proceeds to dispute Beckett's identification of his *Dicranum collinum* with *B. tenuifolia* (H. f. & W.). Beckett in another paper (Trans. N.Z. Inst., vol. 27, p. 403) had referred Brown's moss—"In shallow tarn on top of Mount Thompson, Stewart Island, No. 401 : R. Brown : April, 1892"—to *B. tenuifolia*, citing Mitten's description of the Fuegian plant from the M. Austr.-amer., and figuring the perichaetial leaves, &c. Brown bases his contention (not having seen authentic specimens of *B. tenuifolia*) upon the dissimilarity between Beckett's figures of *B. tenuifolia* and his own of *D. collinum*. The figures of the leaves appear to me to agree perfectly well, and although there is some difference in the form of the capsule, it is no greater than is actually exhibited by different specimens of the plant. Moreover, Brown's drawing of the capsule of his *D. collinum* does not at all accurately represent the actual specimen as preserved in his herbarium, as regards the seta, which is drawn much too stout. And, finally, *D. collinum*, type in Brown's herbarium, is quite undoubtedly a form of *B. tenuifolia*.

So far, then, I have attempted to show that Beckett's reference of R. Brown's two mosses, the one from Waimakariri Glacier, the other from Stewart Island, to *B. robusta* Hampe and *B. tenuifolia* (H. f. & W.) respectively was correct. I wish now to show that these two can only be referred to one and the same species. The Stewart Island plant has a somewhat remarkable and chequered history. R. Brown, in April, 1892, collected a moss in tarns at summit of Mount Thompson, Stewart Island, under what from the evidence of the plants themselves, which are almost absolutely black in colour—only the very youngest leaves showing a faint trace of bronze—must have been nearly glacial conditions. Part of these specimens he sent to Beckett, who in vol. 27 of Trans. N.Z. Inst. (1894) identified them, as mentioned above, with *B. tenuifolia*, while Brown described and figured the plant as *D. collinum*. At some time or other Brown renamed his plant, either forgetting that he had already described it, or thinking that he detected some difference between two parts of the gathering, for the very same plant, with identical labelling as to origin, occurs in his herbarium under the name of "*Dicranum Walkeri* R. Brown co-type."

Meanwhile it appears that Beckett had sent part of the specimens received from R. Brown, unnamed, to C. Müller, who has it in his herbarium as "*Blindia aquatilis* C. Müll., Mount Thompson, Stewart Island," without name of collector (in the Gen. Musc. Fr., p. 245, he gives it as "*Bl. aquatilis* n. sp. von dem See auf Mt. Thompson, in Neuseeland." His specimen is identical in every respect with Brown's *D. collinum* and *D. Walkeri*. This unfortunate plant has therefore been actually referred to four distinct species.

The type specimens of *Dicranum tenuifolium* H. f. & W., from Hermite Island, Fuegia, in the Hookerian herbarium, are almost entirely black in colour, about 1 in. or slightly more in height, the leaves strongly falcate and secund but not circinate, the capsule very small, black, on a rather thin seta, also black (Mitten, it may be observed, describes the seta as "*crassiusculo*"). The figure of capsule of *D. tenuifolium*, Fl. Antarct., tab. clii. fig. 4, is very poor, and must, I think, represent a different thing.

The type of *Blindia robusta* (*leg.* F. Müller) in Hampe's herbarium at the British Museum shows a much more robust bright-bronze-coloured, somewhat glossy plant, with longer leaves strongly and regularly circinate, and a very appreciably larger brown capsule on a much stouter, also brown, seta. Except in these characters of size and colour and of leaf-direction, the two plants are identical, but the differences described are so obvious and striking that it would not be surprising that Hampe, even if well acquainted with *B. tenuifolia*, should consider the Australian plant as new. It would appear, however, that he did not know *B. tenuifolia*, as there are no specimens in his collection, and he makes no reference to it in describing *B. robusta*, which he compares with *B. stricta* (H. f. & W.), a species certainly not nearly so closely allied.

If it had been a question of these two specimens alone, I should have undoubtedly felt that the Australian plant, and Brown's Waimakariri *D. rupestre* (*D. circinatum* in herb.), which is certainly the same, deserved varietal rank at least. But a comparison of other specimens showed that it was impossible to create even a variety on any defined lines. The colour and size, combined with the colour and dimensions of seta and capsule, so conspicuous in the type of *B. robusta*, lose their value when, *e.g.*, the specimen in Herb. Kew., "*D. tenuifolium* H. f. & W., det. Mitten. Australian Alps, 6,000 ft., No. 12, Dr. Muller, 1855," is compared. This, which was probably part of F. Muller's original gathering of *B. robusta*, is just intermediate in size and habit between the two; it has the colour of *robusta*, but is more slender, with the foliation approaching that of *tenuifolia*. There are no capsules. A further specimen, of the same locality and date, No. 84, in Herb. Hook., in rich fruit, has all the characters of *robusta*, but shows a very considerable degree of variation in the size of capsule and thickness of seta, though both are always greater than in *B. tenuifolia* type. *B. tenuifolia*, Mount Wellington, Tasmania, *leg.* Weymouth, 1888, in Herb. Kew. (no doubt the original of *B. Wellingtonii* C. M., Gen. Musc. Fr., which otherwise I have not seen), is *robusta* in the colour and size, and in the colour and size of the capsules, but the brown setae are in no way stouter than in typical *tenuifolia*. *D. tenuifolium*, Tasmania, Archer, det. Mitten, also at Kew, is near *tenuifolia* type in size of plants and of capsule, but a little larger and golden brown in colour; it is, in fact, exactly intermediate between the types of the two supposed species.

D. collinum R. Br. ter. and *D. Walkeri* in Brown's herbarium are perfectly black in both leaves and fruit, with the small capsules of *tenuifolia*, but are far more robust plants than *tenuifolia* type, fully agreeing in size, and length of leaf, with *B. robusta*, but with the leaves rather falcate than circinate, though a stem here and there shows the leaves rather markedly circinate. These also, therefore, are strikingly intermediate between the two extreme forms.

There is little doubt, therefore, that the two are but extreme conditions of one species, and the colour at least is probably due simply to the environment. It is a frequent experience in regard to alpine-arctic mosses that when more or less submerged in glacial streams, or when covered for a considerable period with snow, they tend to become black in hue. This is a marked feature with some of the European high alpine forms of *Philo-*

notis, with *Polytrichum sexangulare*, *Pseudoleskea*, &c. The same conditions would also explain the smallness of fruit in the *tenuifolia* type. The difference in the figures of capsules given by R. Brown in figs. 18–20, Trans. N.Z. Inst., vol. 29, tt. xxxi, xxxii, is amply explained by the above facts. I have not, however, seen on F. Müller's plants (or, indeed, on Brown's specimens, or any other) a capsule quite so elongate and narrow-mouthed as that figured for *B. robusta* (fig. 19). Brown does not state from what specimens his drawings were made.

B. tenuifolia is an easily recognized plant from the habit, the long silky glossy leaves, always very finely subulate to an almost filiform point, entirely composed of the nerve. The cells are uniformly extremely long, narrow, and incrassate, with the exception of the alar cells. These are less highly coloured and form less clearly defined auricles than in some species, but are well marked, usually hyaline, with brown, not very incrassate walls; usually sharply delimited from the narrow, pixta-costal cells, but often passing upwards less abruptly at the margins into the upper, linear cells. As is frequently the case with falcate-secund leaves, the auricles are frequently unequally developed on the two sides of the leaf.

A marked character is the nerve. This is stout and very conspicuous in the upper part of the leaf-base, but lower down almost invariably becomes less distinct, sometimes conspicuously fainter, either from actual narrowing, or thinning-out, or from being less clearly defined at the edges.

At present the two localities referred to above, for both of which we are indebted to the enterprising collecting of R. Brown, are the only New Zealand localities known for this interesting species. Its range is Fuegia, New Zealand, Tasmania, and Australia (Victoria, N.S.W.).*

2. **Blindia contecta** (H. f. & W.) C. M., Syn., 1, 344.

Syn. *Weisia contecta* H. f. & W. in Lond. Journ. Bot., 1844, p. 540; Fl. Antarct., 1, 127, tab. lviii; Handb. N.Z. Fl., p. 405. *Dicranoweisia contecta* Par., Ind., p. 340.

The claim of *B. contecta* to be a New Zealand plant rests on its existence on Campbell Island; it has not at present been found on the mainland.

It is a much more rigid plant than either of the other two species, having the leaves much shorter than in *B. tenuifolia*, straight, rigid, unaltered when dry, and ending in a long, solid, bristly arista; it is also at once known by its entirely immersed capsule on a very short seta, and also by the upper cells, which are very small and short, minutely oval or elliptical, the alar very distinct, the nerve stout.

Distribution. Western Patagonia, Straits of Magellan, Kerguelen Island, Campbell Island.

3. **Blindia magellanica** W. P. Schimp. e C. Müll. in Bot. Zeit., 1862, p. 328. [Plate VI, fig. 14.]

Syn. *B. arcuata* Mitt., M. Austr.-amer., p. 55 (1869). *B. acuta* var. *curviseta* Mitt. in Journ. Linn. Soc. (Bot.), 4, 1859, p. 58. *B. Theriotii* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 335, t. xxxix. *B. globularis* Dus., Beitr. zur Bryol. Magell., &c., in Arkiv för Bot., bd., 4, p. 7, t. 2. *B. consimilis* Card., Fl. Bryol. des Terres Magell., &c., p. 83, fig. 10.

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* Since the above was written I have observed that Watts and Whitelegge, Census Musc. Australiens., p. 41, note under *B. tenuifolia* (H. f. & W.), "In herb. Melb. identified with *B. robusta*."

Very small and slender, rarely an inch in height, leaves more or less greenish-brown, small, about 2·5–3 mm. long, with a fine subula not much longer than the base, not rigid as in *B. contecta*, but only slightly flexuose when dry. Apex finely acute and entire or broad and denticulate (as in the European *B. acuta*). Upper cells all elongate, though the uppermost may be only three times as long as wide, or even slightly less, oblong or linear: all the extreme basal cells usually orange, alar enlarged but not forming so conspicuous auricles as in many species, nerve narrow, thin and often ill defined near base, enlarged above and filling nearly all the subula. Perichaetial longly sheathing, very abruptly narrowed to a setaceous subula, almost entirely composed of the nerve. Seta about 4–5 mm. long, when moist strongly arcuate or cygneous, becoming nearly erect but flexuose on drying. Capsule minute, subglobose, when deoperculate turbinate, and in the dry state with a widely everted rim. Exothecium cells very dense and incrassate, with several rows at the mouth transversely rectangular, deeply coloured and highly incrassate. I have seen only very fragmentary peristome teeth; they are inserted slightly below the mouth.

Mitten describes *B. arcuata* as a separate species in the Musci Austr.-americani, from Hermite Island, Fuegia, J. D. Hooker. In Hooker's herbarium the specimen, which I have examined, figures as "*Weissia acuta* Dill. var.: 130, Hermite Island, Cape Horn: coll. J. D. Hooker," and none of the specimens at Kew have been written up as *B. arcuata* by Mitten. A specimen from Tasmania, "Rocks, Johnny's Creek, *leg.* Oldfield, No. 135, *Blindia acuta* var.," in Mitten's hand, at Kew, is identical with this, the upper leaf-cells showing a tendency to be somewhat shorter, sometimes not more than 3 × 1, or here and there slightly less, and the whole plant being rather smaller, but in all other characters it agrees exactly.

Mitten's name must, however, give way to *B. magellanica*, a MS. name of Schimper's applied to Hooker's Hermite Island plant in herb. Hampe., and fully published by C. Müller in the vol. of Bot. Zeit. for 1862, seven years earlier than the publication of the Musci Austr.-americani. C. Müller (Gen. Musc. Fr., p. 245) has given *B. arcuata* as a synonym of his *B. magellanica* (which, by the way, is twice cited by Watts and Whitelegge in their Cens. Musc. Austral., by a slip, as *B. magellanica* H. f. & W. I have examined the specimen in Hampe's herbarium at the British Museum, which is the type of *B. magellanica* C. M. It is without any doubt identical with —in fact, the same plant as—No. 130, Herb. Hook., Hermite Island, the type of Mitten's *B. arcuata*.

I have seen no record of *B. magellanica* for New Zealand under any of the above names, but it exists in Herb. Kew. under the MS. name "*Blindia Colensoi* n. sp. Broth., No. 2947, New Zealand: comm. Rev. W. Colenso, xi. 1894: det. V. F. Brotherus, ix. 1895." This specimen is in fruit, and agrees exactly with Oldfield's Tasmanian plant referred to above.

Although no specimen of *Blindia Theriotii* R. Br. ter. exists in his herbarium, there can be no doubt from the description and figures (Trans. N.Z. Inst., vol. 35, p. 335, tab. xxxix) that it belongs to *B. magellanica*.

Watts and Whitelegge, in the work just quoted, give both *B. arcuata* Mitt. and *B. curviseta* Mitt. as occurring in Tasmania, and the same distribution is given by Cardot in his work on "Antarctic Bryology," by Paris in the Index Bryol., and by Brotherus in the Musci. I am very sceptical of the existence of *B. curviseta* Mitt. in Tasmania; in fact, it is nearly certain that its record for that island is based upon an erroneous inference—viz., that *B. curviseta* Mitt., Musci Austr.-americani, p. 56 (1869), is the same thing as *B. acuta* Bry. Eur. var. *curviseta* Mitt., in Journ. Linn. Soc. (Bot.), 4, 1859 (Archer's Tasmanian Mosses). The inference, I think, is the other way. If Mitten had intended in the Musci Austr.-americani to take up his varietal name "*curviseta*," raising it to the rank of a species, he would surely have given this varietal name in the synonymy of his new species, and, moreover, would have cited Tasmania in the distribution. The fact that he does not do so implies probably that the Tasmanian plant had escaped his memory, and the identity of the two names is an accident—under the circumstances, a very natural one.

Moreover, Watts and Whitelegge give for *B. curviseta* Mitt. the following localities, quoted doubtless from Fl. Tasman., 2, 172: "Tas., on rocks, Johnny's Creek; Oldfield. On stones, rivulet behind Cumming's Head, W. Mts.; Archer." Now, the latter is the plant cited by Mitten (Journ. Linn. Soc., *loc. cit.*) for his Tasmanian "*B. acuta* var. *curviseta*"; and the former is the actual specimen of *B. magellanica* referred to above in the Kew herbarium, which I have examined there, as also the type in Wilson's herb. at the British Museum, and which is certainly Mitten's *B. arcuata*, not *B. curviseta*.

There is, therefore, no record left of the true *B. curviseta* Mitt. for Tasmania, and the record also (in Watts and Whitelegge) "Victoria, teste Melbourne Census as *B. acuta*" can certainly not be accepted without further evidence. *B. curviseta* Mitt. must clearly be expunged from the Australasian lists. It is, I believe, as at present known entirely confined to the specimen collected on Hermite Island by J. H. Hooker, No. 45 in herb. Wils. (Paris gives Falkland Island, but I do not know on what authority.) The specimen from Kerguelen Island, *leg.* Eaton, labelled "*B. curviseta* Mitt." in Herb. Kew., is not that species. Cardot has provisionally given it a new name, but in my opinion it is the tall form of *B. magellanica*, exactly agreeing with the middle specimen of Hooker's type, "*Weisia acuta* var., 45*b*. W. 130," of *B. arcuata*—*i.e.*, *B. magellanica*. It differs, as does that specimen, in the more distant, finely setaceous leaves, from the fruiting plant, but in no other way. The capsule and seta of Eaton's plant agree with *B. magellanica*.

The upper cells of *B. magellanica* are in Hooker's specimens frequently quite short, often as little as 2 × 1 and 3 × 1; and on first examining them I was disposed to think that *B. curviseta* Mitt. was only an extreme form; closer study, however, led to a different conclusion. The upper cells in *B. curviseta* are regularly quadrate (not "rounded" as Mitten states, meaning probably simply isodiametrical as opposed to elongate), and the whole tissue tends to be shorter and less firm and narrow than in *B. magellanica*. The nerve occupies less of the subula, so that the cells of lamina are more numerous and more conspicuous high up in the leaf, and there are other differences which are pointed out by Wilson in a MS. note on his specimen of No. 45, Hermite Island: "Leaves more setaceous and acute at the apex than in Oldfield 135" [*i.e.*, *B. magellanica*] "(often white-tipped), nerve wider. Seta thicker and shorter. Capsule shorter and almost oblate, less evidently apophysate." All these characters except the last, as regards the capsule neck, I find borne out by the specimens I have examined; and, although strikingly near one another, *B. curviseta* and *B. magellanica* are no doubt to be retained as distinct species.

EXCLUDED SPECIES.

Blindia (?) *torlessensis* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 335, t. xxxix, does not exist in R. Brown's herbarium; but from the description and figures there can be no doubt that it does not belong here. The upper cells are quadrate, the lower "quadrilateral" (*i.e.*, oblong or rectangular), the peristome teeth bifid for one-third their length. Brown says nothing about enlarged alar cells, to which he usually refers in his later articles, when present. It is almost certainly *Dicranella cyrtodonta* (C. M.).

Dicranum lancifolium (Blindia?) R. Br. ter. *op. cit.*, vol. 29, p. 458, t. xxxi, from the leaves is certainly not a *Blindia*, and I should have little doubt is *Tridontium tasmanicum* (H. f. & W.), to which I should also be strongly inclined to refer *D. rostratum* of the same author (*op. et loc. cit.*), in spite of some slight disagreement in the peristome teeth, which, as figured, are highly irregular. I have, however, New Zealand specimens of the *Tridontium* in which the peristome approaches very closely that figured here. There is no specimen of *D. lancifolium* in Brown's herbarium.

Blindia chrysea C. M. & Beck. is *Dicranoweisia antarctica* (C. M.).

Blindia calcarea R. Br. ter. MS. in herb. is *Seligeria Cardotii* R. Br. ter.

DICRANELLA W. P. Schimp., Coroll., p. 13 (1855).

Dicranella is a large genus of approximately 200 species, and, unfortunately, does not admit of division into well-defined groups. This is evident from the different ways in which it has been treated by various authors. The subgenus *Anisothecium* Mitt. has been frequently—as by its author—considered a distinct genus, and here one might look for some clearly defined characters. That this is not the case is perhaps best evidenced by the fact that while Mitten's *Anisothecium* may be considered to be founded, as Limpricht states, on *Dicranella varia* (Hedw.), this species is removed from *Anisothecium* by C. Müller, and placed (in Gen. Musc. Fr.) under *Dicranella*.

I have adopted the divisions as defined by Brotherus, while frankly feeling that they do not appear to me so clearly characterized as one could desire. In any case, it is scarcely possible to identify certain of the species with accuracy without a careful examination of the ripe fruit and peristome.

Brotherus divides *Dicranella* into three subgenera, briefly characterized as follows:—

Subgen. I. MICRODUS Schimp.—Capsule smooth, not plicate-striate, small, erect, usually ovate and narrow-mouthed. Annulus well developed. Peristome teeth very short, perforated, often irregular.

Subgen. II. DICRANELLA sens. strict. Lindb.—Nerve at base of leaf broad and flat, not well defined. Capsule, at least after maturity, plicate-striate, more or less thin-walled, upright or inclined. Exothecium cells elongate (prosenchymatous), irregular with curved walls. Peristome teeth more highly developed, yellowish or reddish-brown, faintly papillose. Seta often pale.

Subgen. III. ANISOTHECIUM Mitt.—Nerve at base narrow and well defined. Capsule smooth, thick-walled, usually curved. Exothecium cells regularly rectangular or quadrate. Annulus not developed. Peristome large, deep, red, closely papillose.

Subgen. II is not, so far as I am aware, represented in New Zealand. *Aongstroemia cyrtodonta* C. M. is referred by its author to *Weisiella*—*i.e.*, *Microdus*—but I am convinced that this is incorrect, its true place being in *Anisothecium*. All the New Zealand species, therefore, belong to that subgenus.

There has been much confusion between certain of the New Zealand and some South American species. I am far from sure that I have been able to clear up the uncertainty in all cases, but I believe that some at least of the difficulties will be found solved in the following treatment.

Unfortunately, none of R. Brown's species of *Dicranella* (described in Trans. N.Z. Inst., vol. 29, p. 451, as *Dicranum*) are to be found in his herbarium. I have, therefore, only been able to make suggestions as to their identity. The fact that no other species of *Dicranella* are represented in the collection increases the probability that some or all of his species are identical with species already described, with which there is evidence that he was unacquainted.

KEY TO THE SPECIES.

1. Leaves all from a distinctly sheathing base abruptly narrowed to a long, spreading acumen; upper cells papillose 2
   Leaves, at least the lower, not or scarcely sheathing, more gradually tapering; cells smooth 3

2. Stems tall, leaves distant, peristome teeth filiform above, highly and densely cristate-papillose .. .. 1. *clathrata*.
   Stems shorter, leaves closely set (habit of *D. Schreberi*), peristome teeth broad, striolate above or lowly papillose .. .. 2. *wairarapensis*.

3. Capsule very minute, less than 1 mm. long without lid, erect and symmetrical 4. *gracillima*.
   Capsule larger, 1 mm. or more long, inclined and curved 4

4. Leaves small, about 2 mm. long, gradually tapering to acumen, the upper (excluding the perich. bracts) subequal, and similar. Seta 5-7 mm. 5. *cyrtodonta*.
   Leaves longer, flexuose, the upper at least from a wide sheathing base; seta 6–20 mm. long .. .. 3. *Jamesonii*.

1. **Dicranella clathrata** H. f. & W., Fl. N.Z., 2, 65.

Syn. *Dicranum clathratum* H. f. & W. in Lond. Journ. of Bot., 1844, p. 542; Handb. N.Z. Fl., p. 411. *D. vaginatum* var. *clathratum* H. f. & W., Fl. N.Z., 2, 65. *Aongstroemia clathrata* C. M., Syn., 2, 608. *Dichodontium clathratum* Jaeg., Adumbr., 1, 86. *Dicranum campylophyllum* H. f. & W., Fl. N.Z., *loc. cit.*; Handbook, *loc. cit.*, p.p. (*nec* Tayl.). *Aongstroemia lonchorrhyncha* C. M. in Hedw., 1898, p. 114. *Dicranella lonchorrhyncha* Par., Ind., p. 331. ? *Dicranum Cardoti* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 329, t. xxxvi. ? *D. papillosum* R. Br. ter., *op. cit.*, vol. 29, p. 456, t. xxix. ? *D. subulatifolium* R. Br. ter., *op. cit.*, p. 457, t. xxx. *Dicranum variabile* R. Br. ter., *op. cit.*, p. 455, t. xxix. *Dicranella variabilis* Par., Suppl. Ind., p. 119.

A tall species, 1-2 in. high, or under abnormal conditions the sterile plant may be much taller. An inhabitant of wet places. Distinct in the distant leaves, with long, pale, sheathing bases, by which the stem is completely hidden, the upper part of the sheath of one leaf enclosing the lower part of the succeeding one.

The statement in the Handbook that the leaf subula is "wholly occupied by the stout nerve" is not quite correct. The lamina is, I believe, constantly, or nearly so, distinct to apex, but the cells are papillose and obscure, and it is very difficult or impossible to observe the delimitation of the nerve without sectioning.

The leaves are dull lurid green above, squarrose when moist, but crisped when dry. The points are variable, either broad at apex and coarsely denticulate, or narrowly tapering and entire. The seta varies in length. The capsule is sometimes erect and symmetrical, but often inclined and asymmetrical, elliptic-ovate or shortly ovate, when deoperculate rather wide-mouthed, so that the capsule is turbinate; the lid rostrate with a straight or curved beak.

The peristome is large, the teeth broad and united at base, above divided each into 2–3 irregular branches, which are long, filiform, and very variously connected together, sometimes being almost free throughout their length (in which case the undivided portion is short and the peristome very unlike the typical Dicranelloid structure), much more frequently united at frequent intervals by transverse bars, which sometimes leave such small spaces between them as to be more of the nature of perforations in a solid structure, whence the name "*clathrata*." The basal membrane is closely barred, while the filiform branches are densely and very highly cristate with close papillae, so that their internal structure is entirely hidden. This structure of the peristome is completely different from that prevailing in any of the other New Zealand species.

D. clathrata was at first described as var. *clathratum* of *D. vaginatum* Hook. (*Dicranella vaginata* Card.) of South America. The two plants are apparently identical in everything but the peristome, which, while of the same minute structure in *D. vaginata*, has each tooth regularly divided into two long filiform branches, which are free, or nearly so, for the whole of their length.

This species occurs in both North and South Islands; I have an elongate, sterile form, 5 in. long, collected near Lake Wakatipu by J. Meiklejohn in 1906. It appears to be found principally in wet places near waterfalls, and seems to be endemic to New Zealand.

Dicranum campylophyllum Tayl.? (Fl. N.Z., 2, 65; Handb., p. 411) is, so far as Joliffe's plant is concerned, only *D. clathrata* (e spec. auctoris orig. in Herb. Hooker.). Hampe's plant under this name is no doubt, as C. Müller states (Gen. Musc. Fr., p. 321), identical with his *Aongstroemia redunca*—*i.e.*, *D. Jamesonii* below.

No specimen of *Dicranum variabile* exists in R. Brown's herbarium, but from the description and figures I do not think there can be the least doubt that it is *D. clathrata*—a plant evidently not known to Brown, who does not mention it among the New Zealand species of *Dicranum*. The other reductions I have suggested of Brown's species in the synonymy are more tentative, but I think there can be little doubt of their correctness.

Aongstroemia lonchorrhyncha C. M. (type in C. Müller's herb., Auckland, *leg.* Cheeseman) shows no differences from *D. clathrata*. There is nothing in the description to suggest any difference, and C. Müller has not compared his plant with *D. clathrata* or any other species. The capsule is inclined, but this is the case frequently with both *D. clathrata* and *D. vaginata*. Wilson's sketches of the type of *Dicranum clathratum* H. f. & W., at the British Museum, show capsules both erect and oblique, and varying in outline, while the specimens themselves show the variation in form still more markedly. This variability is still more pronounced in the closely allied South American *D. vaginata*.

2. Dicranella wairarapensis sp. nov. [Plate VI, fig. 15.]

Dioica. Caespites *densi*, pollicares, superne pallide virides, inferne ferruginei, habitu *D. Schreberi* Hedw. Caulis simplex vel parce divisus, strictiusculus; folia *parva*, infra laxiuscula, supra sat conferta, e basi *brevi vaginante, subamplexicauli, erecta*, raptim in subulam *breviusculam lineari-lanceolatam, valde squarrosam, integram subobtusam*, siccitate *crispatam*, angustata; 1–1·5 mm. longa. Costa *debilis*, inferne latiuscula,

male definita, in subula *tenuis, angusta, pellucida, indistincta*, infra apicem soluta. Cellulae basilares omnes *anguste lineares*, elongatae, eae subulae ***brevissime rectangulares vel subquadratae***, 5–8 μ latae, omnibus ***papillis creberrimis obscuratae, scabridae***, parietibus tenuibus.

Flores masculi in caulibus propriis inter femineos intermixtis terminales, gemmiformes, grossiusculi. Bracteae perichaetiales minus squarrosae, in subulam longiorem tenuiorem acutam minus abrupte angustatae. Seta ***brevis***, 5–7 mm. longa, saturate rubra; theca parva, deoperculata vix 1 mm. longa, *erecta, symmetrica*, fusco-rubra, elliptica, ore latiore (sicca subturbinata ?), operculo subaequilongo, rostellato. Exothecii cellulae rectangulares, *opacissimae, parietibus transversalibus obscuris, longitudinalibus contra pellucidis*. Annulus nullus. Peristomium magnum, infra orificium paullo insertum, dentibus e membrana basilari brevissima *late lanceolatis*, infra intense rubris, apicem versus in 2–4 crura irregularia pallidiora divisis vel hic illic perforatis, sat regulariter densiuscule transverse trabeculatis, parte dimidia inferiore sat dense papillosis, supra—praecipue ad crurium basin—longitudinaliter striolatis, summo apice crurium hyalino dense papillosis. Spori 20–25 μ, laeves.

Hab.—Mauriceville, Wairarapa, North Island; December, 1908; *leg.* W. Gray (No. 27).

A well-marked species, having the habit of *D. Jamesonii*, or still more of the European *D. Schreberi* (Hedw.), but at once distinct from these by the erect theca and densely papillose cells. From *D. clathrata* it differs in the more compact tufts, much closer and smaller leaves, with the subula entire and still more obscure and papillose, and the peristome entirely different in form and sculpture. The leaf-cells of the subula are more highly papillose and obscure than in *D. clathrata*, so that the thin nerve appears as a narrow pellucid line, instead of darker or concolorous as in that species.

The structure of the exothecium is somewhat peculiar: the cells themselves are highly opaque, and the transverse walls are narrow and inconspicuous; the longitudinal walls, on the contrary, are wider and comparatively translucent, and these, as the cells are placed in regular longitudinal rows, appear as regular pellucid lines running the length of the otherwise opaque capsule.

3. Dicranella Jamesonii (Mitt.) Broth. in Engl. & Prantl, Musci, p. 311.

Syn. *Dicranum Jamesoni* Tayl. in Lond. Journ. Bot., 1848, p. 281. *Anisothecium Jamesoni* Mitt., M. Austr.-amer., p. 39. *Aongstroemia subredunca* C. M. in Hedw., 1898, p. 114. *Dicranella subredunca* Par., Suppl. Ind., p. 118. *Aongstroemia redunca* C. M. (false "H. f. & W.") in Hedw., 1898, p. 115, et Gen. M. Fr., p. 321. *Dicranum Schreberi* H. f. & W., Fl. N.Z., 2, 65; Handb. N.Z. Fl., p. 411 (*nec* Hedw.). *D. campylophyllum* H. f. & W., Fl. N.Z., 2, 65; Handb., *l.c.*, p.p. ? *Dicranum waimakaririense* R. Br. ter. in Trans. N.Z. Inst., vol. 36, p. 330, t. xxxvi.

This is, I believe, the most frequent species in New Zealand, and the one responsible for most of the difficulties that have arisen in connection with the genus. It is certainly the plant referred to *D. Schreberi* by Hooker and Wilson, followed by other authors and collectors, and is, indeed, very near that species. *D. Schreberi*, however, has the leaves—as pointed out in the Handbook—denticulate towards apex, while in the New Zealand plant

they are entire, or with a few indistinct teeth at the tip only; *D. Jamesonii* is also (as regards the fertile plant) a more robust species, and the leaves are less vaginant. In *D. Schreberi* nearly all the leaves on the stem are strongly and widely sheathing, only the lowest on the stem failing in this respect; in the New Zealand plant the lower leaves are comparatively narrow at base and not sheathing, but they become wider and more sheathing in gradual succession higher up the stem, until the comal ones are highly vaginant and very similar in form and arrangement to those of *D. Schreberi*.

I have not seen the New Zealand plant (*leg.* Kirk) referred by Mitten to his *Anisothecium Jamesoni* (*cf.* Beckett in Trans. N.Z. Inst., vol. 26, p. 286), but there can be no doubt that it is the same plant as that referred in the Handbook to *D. Schreberi*. *Anis. Jamesoni* (Spr., M. Amazon. et Andini, 34) has narrower leaves with longer points and rather firmer, more elongate areolation than in most of the New Zealand plants, but it is an extremely variable plant in length and width of subula, &c. (as is also *D. Hookeri* (C. M.), with which Mitten united it—erroneously, as Cardot has pointed out in the Fl. Bryol. de l'Antarctide, p. 60); this is exemplified also in the New Zealand plants, which show much variation in this and other respects.

There are no specimens of the true *D. Schreberi* (Hedw.) from New Zealand in either Hooker's or Wilson's herbaria, nor in the national collections in London.

I have examined the type of *Aongstr. reduncа* C. M. and *A. subredunca* C. M., and have no hesitation in referring both to this species. The only difference between the two suggested by C. Müller of any importance in his comparison in Hedwigia is in the length of lid, which is conical in *A. subredunca* and rostrate in *A. redunca*. But *D. Jamesonii* is very variable in this respect; on the same tuft I have seen the lid longly rostrate and exceedingly the capsule length, and also shortly rostellate, considerably less than the capsule length. This is still more markedly the case with the allied *D. Schreberi* (Hedw.). There were no operculate capsules on the specimen received from C. Müller's herbarium.

C. Müller has somewhat increased the confusion by carelessness in his citation of authorities. In Hedwigia (*loc. cit.*) he writes, "*Aongstroemia redunca* (Hook. & Wils.)." This may be merely a slip, but I am inclined to think his intention was to write, "*Aongstroemia redunca* M. (*Dicranum Schreberi* Hook. & Wils.)." In the Gen. Musc. Fr., p. 321, he enumerates "*A. redunca* n. sp. (*Dicranella campylophylla* Hpe. Hb., nec Tayl.); *A. subredunca* n. sp.; und *A. gracillima* n. sp. von der Sudinsel Neuseelands." (The latter should read, "*A. gracillima* C. M. & Beck.").

Hampe's New Zealand "*D. campylophylla*" is no doubt the same thing as C. Müller's *A. redunca*, as the latter states; but it is not the *Dicranum campylophyllum* of Taylor, nor again the *D. campylophyllum* of the Handbook. *D. campylophyllum* Tayl. is not a New Zealand moss, and is, in any case, not near Hampe's plant, which has smooth cells, those of *D. campylophyllum* Tayl. being slightly papillose, at any rate at margin. Colenso's plant referred to *D. campylophyllum* by Hooker and Wilson figures in Hooker's herbarium as "*Dicranum* allied to *Schreberi*," and on another specimen Wilson has written "N.Z., Col. 502: *D. campylophyllum* Tayl.?" This is certainly the same plant as the plant of Hooker's own collecting ("No. 328, New Zealand, *Dicranum Schreberi* var."), and is the *D. Jamesonii*. It is not at all clear to me why in the Handbook the authors give both this supposed *D. campylophyllum* and also "*D. Schreberi*" in addition.

No specimen can be found of *Dicranum waimakaririense* in R. Brown's collection, but from the description and figures it may, I think, very safely be referred here.

The capsule in *D. Jamesonii* is not, properly speaking, strumose (*cf.* Handbook, p. 411, sub *D. Schreberi*), but when the capsule is dried before maturity a substrumose ring is formed at the neck.

D. Jamesonii appears to be widely distributed in New Zealand. C. Müller's specimen of *Aongstr. subredunca* bears a few subglobose or elliptical gemmae arising from axillary rhizoids on the stems. They are articulate, smooth, orange-brown. I have described and figured almost exactly similar ones on *D. heteromalla* from Madeira (*cf.* Journ. Bot., October, 1909, t. 199), and they occur also on species of *Barbula*, and frequently on *Leptobryum pyriforme* Wils.

4. Dicranella gracillima (C. M. & Beck.) Par., Ind., p. 329.

Syn. *Anisothecium gracillimum* C. M. & Beck. in Trans. N.Z. Inst., vol. 26, p. 287, t. xxx. *Aongstroemia gracillima* C. M. in Hedw., 1898, p. 114; Gen. Musc. Fr., p. 321. *Dicranum pygmaeum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 454, t. xxix. *Dicranella pygmaea* Par., Suppl. Ind., p. 118. *Dicranum pusillum* R. Br. ter., *op. cit.*, p. 455, t. xxix. *Dicranella pygmaea* Par., Suppl. Ind., p. 118.

Paris cites this species as *Anis. gracillimum* Mitt., while C. Müller himself refers to it in Gen. Musc. Fr. (1901) as *Aongstr. gracillima* n. sp. It was, however, described and figured by Beckett as quoted above, in 1893, from a specimen "Pine Hill, Dunedin; W. Bell (det. C. M.)," and should be cited as of C. M. & Beckett. It stands in C. Müller's herbarium as "*Aongstr. gracillima* C. Müll., N.Z., Pine Hill, Dunedin, *leg.* W. Bell," and the same citation is given in Hedwigia (*loc. cit.*), showing that the reference "n. sp." is a slip merely, and does not refer to another plant.

The two species of *Dicranum* described by R. Brown which are here placed in the synonymy of *D. gracillima* are not in his herbarium, but I do not think there can be any question that they represent two forms of this plant differing slightly in size, the only difference suggested by his description being that the calyptra covers the greater part of the capsule in *D. pusillum*, while it scarcely covers the operculum in *D. pygmaeum*.

D. gracillima is known by its very small size, slender habit, small leaves, and minute, erect, and symmetrical capsule, somewhat wide-mouthed when dry. The cells, especially in the lower leaves, are markedly wide and thin-walled, and are all elongate; and the nerve is much weaker than in most species. It is not unlike the European *D. rufescens* Schimp.

The known localities all lie, I believe, in the South Island.

5. Dicranella cyrtodonta (C. M.) Par., Ind., p. 328. [Plate VI, fig. 16.]

Syn. *Aongstroemia cyrtodonta* C. M. in Engler's Bot. Jahrb., 1883, p. 87. ? *Blindia* (?) *torlessensis* R. Br. ter. in Trans. N.Z. Inst., vol 35, p. 339, t. xxxix.

C. Müller refers this species to *Weisiella*; but the capsules are decidedly inclined and asymmetrical, the mouth wide, the peristome large and well developed with close papillae, the exothecium cells regularly quadrate. I think there can be no doubt that its proper place is in *Anisothecium*.

D. cyrtodonta is distinct in the leaves, which, except the perichaetial ones, have not the wide, abruptly contracted sheathing base characteristic of the upper leaves at least of the other species (except *D. gracillima*). The leaf-points are short and wide and pellucid, so that, though the nerve is broad, it does not occupy a great part of the width of the subula, where the cells of the lamina are rather wide, empty, and pellucid, and subquadrate or shortly rectangular, with firm but rather thin walls. *D. Jamesonii* has the upper cells somewhat similar in form, but they are rarely quadrate, have less firm walls, and are therefore more irregular in shape, while they are rendered much more obscure by the cell-contents.

The leaves have usually one margin very narrowly and closely recurved.

Blindia (?) *torlessensis* R. Br. ter. is certainly, judging from the description and figures, a *Dicranella*, and, I think, with little doubt is referable to *D. cyrtodonta*, although the author describes the leaves as sheathing, which is applicable only to the perichaetial ones; the leaves in *D. cyrtodonta* are, however, wide at the base and embrace the stem, which is perhaps all that Brown implies by his term.

The very perfunctory description of *Aongstr. cyrtodonta* by C. Müller gives no locality beyond "Nova Seelandia" for Dr. Naumann's plant.

INCERTAE SEDIS.

Dicranella erecto-theca (R. Br. ter.) Par., Suppl. Ind., p. 116 (*Dicranum erecto-theca* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 155, t. xxix), is no doubt a *Dicranella*, but the figures and descriptions do not admit of a close estimate of its position.

Dicranum craigburnense, *D. Gulliveri*, and *D. clintonense*, described by the same author in the same publication, are also quite doubtful species, apparently belonging to this genus.

Dicranella lancifolia (R. Br. ter.) Par. and *D. rostrata* (R. Br. ter.) Par. are certainly referable to *Tridontium tasmanicum*, while *D. rupestris* (R. Br. ter.) Par. is identical with *Blindia robusta* Hampe.

D. Cockaynii (R. Br. ter.) Par. and *D. debilis* (R. Br. ter.) Par., described by Brown in Trans. N.Z. Inst., vol. 29, p. 156, tt. xxix, xxx, as *Dicranum*, seem to me to belong here rather than to *Dichodontium*, as Brotherus suggests. *D. Cockaynii* might quite conceivably be the plant described as *D. wairarapensis* above. Unfortunately, these species are not to be found in Brown's herbarium, and their identity must remain doubtful.

CAMPYLOPODIUM Besch., Fl. Bryol. Nouv. Caled. in Ann. d. Sc. nat., 13, 189 (1873).

This small genus, which may be described as having the habit of *Campylopus* but the vegetative characters of *Dicranella*, is considered by Brotherus to be doubtfully deserving of separation from the latter genus. Apart, however, from the cygneous seta and setaceous leaves, it has the pachydermatous capsule, furrowed when dry, of *Campylopus*, and it appears to me desirable to maintain it as distinct from *Dicranella*. It seems questionable whether *Microcampylopus* C. M. should not be united with it.

The species included here appear under *Dicranodontium* in the Handbook.

KEY TO THE SPECIES.

Upper leaf-cells smooth: leaves abruptly narrowed from a wide, vaginant base, nearly entire .. .. 1. *euphorocladum.*

Upper leaf-cells rugulose with the projecting cell-walls; leaves more gradually narrowed from a lanceolate base, serrulate above .. 2. *Buchanani.*

1. **Campylopodium euphorocladum** (C. M.) Besch. in Ann. d. Sc. nat., *loc. cit.* [Plate VI, fig. 17.]

> Syn. *Aongstroemia euphoroclada* C. M., Syn., 1, 429. *Campylopus euphorocladus* Bry. jav., 1, 79, t. 66. *Dicranella euphoroclada* Jaeg., Adumbr., 2, 637. *Campylopus nanus* Bry. jav., 1, 74, t. 61 (*nec* C. M.). *Dicranum pseudo-nanum* C. M. in Bot. Zeit., 1859, p. 190. *Campylopus pseudo-nanus* Jaeg., Adumbr., 1, 120. *Microcampylopus pseudo-nanus* C. M. in Hedw., 1899, p. 78. *Dicranodontium flexipes* Mitt., MS. ex H. f. & W., Handb. N.Z. Fl., p. 413. *Campylopodium flexipes* Broth. in Engler and Prantl, Pflanzenfam., Musci, 1, 312. *Dicranum proscriptum* H. f. & W., Fl. N.Z., 2, 67 (*nec* Hornsch.). *Campylopodium tahitense* Besch. in Ann. d. Sc. nat., 1895, p. 15.

The synonymy of this and the following species have been considerably extended by the redescription of the same plant from different parts of the Pacific and Malaysian regions under different names; but in addition to this a good deal of confusion has been introduced through careless reference to and neglect of authorities. A considerable part of the above synonymy is taken from Fleischer (Musci von Buitenzorg, 1, 62), by whom the identity of the New Zealand plant (*Dicranodontium flexipes* Mitt.) with the Javan species was first detected. Fleischer, however, has been led into some error by copying Paris (Index, ed. 1, p. 237), where references are remarkably transposed. Thus *Grimmia Buchanani* Stirt. has nothing to do with the present plant, but belongs to the following species, while the synonymy of the St. Helena plant, which Mitten pointed out is not identical, as Hooker and Wilson in the Flora of New Zealand supposed, with the present species, is quite incorrectly given. It should probably read as follows:—

CAMPYLOPODIUM PROSCRIPTUM (Hornsch.) Broth. in Engler and Prantl, Pflanzenfam., Musci, 1, 312.

> Syn. *Didymodon proscriptus* Hornsch. in Hor. Phys., Berol., p. 60, t. 12. *Leptotrichum Hornschuchii* C. M., Syn., 1, 450. *Dicranella proscripta* Mitt. in Melliss, St. Helena, p. 357. *D. cygnaea* Aongstr. in Oefv. af K. Vet.-Akad, Foerh., 1878, n. 5, p. 47. *Campylopodium cygnaeum* Par., Ind., p. 237.

C. euphorocladum is probably widely distributed in New Zealand. I have it in my herbarium from two or three localities in the North Island, including one in the extreme north, collected by Beckett; and also from Dunedin, South Island, where it was collected by W. Bell. In general habit it closely resembles the following species, with the appearance of a very small species of *Campylopus*, a quarter to half an inch in height, with very delicate, setaceous, silky foliage. It is, indeed, scarcely to be separated from *Campylopus* until the leaves are examined under the microscope, when the comparatively narrow nerve, longly excurrent in the flexuose arista, and the short upper cells and general Dicranelloid structure of the areolation shows its position. The differences between it and the following species are dealt with under the latter plant.

2. **Campylopodium lineare** (Mitt.) Dixon comb. nov. [Plate VI, fig. 18.]

Syn. *Dicranodontium lineare* Mitt., MS. ex H. f. & W., Handb. N.Z. Fl., p. 413. *Grimmia Buchanani* Stirt. in Proc. Nat. Hist. Soc. of Glasgow, 1876, p. 187. *Aongstroemia Buchanani* C. M. in Hedw., 1898, p. 116. *Campylopodium Buchanani* Par., Suppl. Ind., p. 88.

Neither Stirton nor C. Müller was acquainted with the preceding species as a New Zealand plant. In his description of *A. Buchanani* C. Müller makes no reference to *C. euphorocladum* (or *flexipes*), but compares his plant with *Campylopodium capillaceum* (H. f. & W.), which is a very different plant now placed in *Campylopus* (*C. Holomitrium* Jaeg.). Consequently his description of the present plant takes no account of its differences from *C. euphorocladum*; in fact, it is far more applicable to that species than to the one which is being described! The only point in the diagnosis which is more applicable to *C. lineare* is the description of the base as "parum dilatate vaginata." The same remark applies to Stirton's description of his *Gr. Buchanani*. I have, however, good specimens of the original gathering made by Buchanan, "Wellington, N.Z., *leg.* J. Buchanan," sent me by Mr. D. Petrie, from which I have been able to ascertain not only the distinguishing characters of what is no doubt a good species, but also, with scarcely a doubt, its identity with the *Dicranodontium lineare* Mitt. of the Handbook, no specimens of which, unfortunately, are to be found in Mitten's herbarium, or in either of the national collections in London.

The sheathing portion of the leaf is, as pointed out by Mitten, much narrower than in *C. euphorocladum*, being ovate-lanceolate rather than widely ovate or obovate: the subula is rather stouter, and the lamina usually (I believe, constantly) extends much higher up in the leaf, frequently remaining in 1–3 rows of cells almost to the extreme apex. The upper cells are shortly rectangular, and the greater part of the margin of the subula is distinctly serrulate, while the projecting transverse walls of the cells render the surface of the leaf finely scabrous or rugulose. The back of the nerve is also somewhat denticulate.

The inflorescence is, as described by Mitten, autoicous; not dioicous, as C. Müller gives it. The ♂ flower is terminal on a separate branch, below the perichaetium, the perigonial bracts ovate to ovate-lanceolate, the antheridia few and small, about 0·02 mm. long, narrowly clavate; paraphyses few and inconspicuous.

The capsule differs somewhat from that of *C. euphorocladum*. In that species it is ovate or somewhat fusiform, being narrowed at the base to a substrumose, equal apophysis, and also above to a somewhat small mouth, below which also it is slightly constricted. After deoperculation and on drying the capsule remains of approximately the same form, becoming deeply plicate, somewhat (though less strongly) narrowed at the mouth, and also constricted below it. In *C. lineare* the capsule is slightly shorter, and less narrowed above, so that the empty dry capsule is scarcely narrower above than in the middle, though somewhat constricted below the mouth: it is, in fact, distinctly urceolate.

The lid in both species is sharply beaked approximately half the length of the capsule. I have not detected any difference between the two species in peristome or spores: the latter are rather large, 20–30 μ, somewhat irregular in form, opaque with close granulations.

The original locality, in Canterbury (Travers), and Buchanan's station near Wellington, appear to be the only known records.

[DICHODONTIUM Schimp.

Brotherus (Musci, p. 316) suggests that four species of *Dicranum* described by R. Brown in Trans. N.Z. Inst., vol. 29, pp. 456–57 (viz., *D. Cockayni*, *D. debilum*, *D. papillosum*, and *D. sublatifolium*), may very possibly belong to this genus, being no doubt partly guided to this conclusion by the description of the cells as papillose. Unhappily, not one of these four species exists in Brown's herbarium; but from a careful comparison of the figures and descriptions, together with their position in Brown's arrangement (next to *D. Schreberi*), I have little doubt that they belong rather to *Dicranella*, to which, too, their narrow-pointed vaginant leaves would attach them: and in regard to the last two species I have scarcely any hesitation in referring them—as I have done above—both to *D. clathrata*. *Dichodontium*, moreover, is unrepresented in Australia, and is mostly confined to Europe and North America, a single additional species being found in the Himalaya, and two others in Chile and the Magellan region. It must, I think, therefore, be certainly excluded at present from the New Zealand list.]

DICRANOWEISIA Lindb.

The genus *Dicranoweisia* is rather difficult to define, on the one hand from *Blindia*, and on the other from *Dicranum*. C. Müller, indeed, includes *Dicranoweisia* under *Blindia*, while Mitten (M. Austro-amer.) makes it a section of *Dicranum* as *Isocarpus*. The crisped leaves (when dry), of less firm texture, with the alar cells only moderately developed, short erect capsule, and rather poorly developed peristome are the chief characters, but in the only New Zealand species the alar cells are highly developed, while in this and in the European *D. crispula* the peristome teeth are slightly striolate as in *Dicranum*. It is therefore somewhat hard to justify its separation from *Dicranum*, the more so in view of the § *Holodontium* Mitt. of that genus, where the peristome is almost identical with that of *Dicranoweisia*; and I am strongly inclined to think that it would be more satisfactory to unite the species of *Holodontium* with the present genus so long as it is retained as separate from *Dicranum*. The generic name very aptly describes the relationships of the group.

Dicranoweisia antarctica (C. M.) Par., Ind., p. 339.

Syn. *Blindia antarctica* C. M., Syn., 1, 344. *Dicranum antarcticum* Mitt., M. Austro-amer., p. 63. *Weissia crispula* H. f. & W., Fl. Antarct., 1, 127, t. 58 (*nec W. crispula* Hedw.). *W. crispula* var. *ambigua* Wils., Handb. N.Z. Fl., p. 404. *Blindia chrysea* C. M. & Beck. in Trans. N.Z. Inst., vol. 25, p. 290. *Weissia chrysea* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 441, t. xxxvii. *W. Webbii* R. Br. ter., *op. cit.*, p. 440, t. xxxviii.

This plant was referred by Hooker and Wilson to *D. crispula* (Hedw.), a widely spread species on the colder mountains of the Northern Hemisphere. The New Zealand and Antarctic plant, however, differs in certain definite characters: the alar cells are very strongly developed, forming clearly marked auricles; the remaining basal cells are narrower and firmer, the plants taller, and the capsule quite smooth when dry, while in the true *D. crispula* it is slightly plicato-striate. The disposition of the leaves when dry in *D. antarctica* is also characteristic: the lower part remaining scarcely altered, while the upper half is strongly crisped. The capsule varies a good deal in outline, from turgidly oval to rather longly elliptical, and is always slightly contracted at the mouth. The peristome is fragile and soon lost; and I have not seen capsules in good condition for examination. The teeth are entire or only slightly and irregularly divided or perforated at the tips, slightly papillose, and sometimes at least showing vertical striolae in the lower or median part. The spores measure about 20 μ, and are finely granulate. I have not been able to detect the presence of stomata on the capsule, but they are present in all the European species.

The identity of the New Zealand "*W. crispula*" with *Dicranum antarcticum* C. M. was recognized by Hooker and Wilson in the Handbook, p. 404; but it seems to have been lost sight of since then in New Zealand: this, however, was not from any want of knowledge of the plant itself, which has been widely collected and known as *Blindia chrysea* C. M. C. Müller's type specimens of this, as well as numerous others which I have examined of Beckett's and Brown's, show that it is absolutely identical with the original *Blindia antarctica* C. M. *Weissia Webbii* in R. Brown's herbarium is also the same thing. In his article (*loc. cit.*) on *Weissia*, R. Brown refers to Beckett's publication of *Blindia chrysea* under that genus as a mistake, the capsule in *Blindia* being turbinate or subpyriform; not recognizing that *Blindia* is used by Müller in a wider sense, including the species of *Dicranoweisia*. *Blindia chrysea* should properly be cited as of C. M. & Beckett. Brown's note may here be recalled as to the colour of the present species—yellowish green when its habitat is on rocks, where the plants are subject to be often dried up; dark green when the habitat is on damp banks.

"*Weissia crispula* (?) Ludwig"* (R. Brown, *loc. cit.*, p. 440) is not the present plant, from the specimens in Brown's herbarium so named; it is *Weisia flavipes* H. f. & W.

D. antarctica has an interesting distribution. It is evidently widely spread over the South Island, but I have seen no records from the Northern Island, nor from Tasmania. It is known also from Campbell Island, and, outside the New Zealand region, from Hermite Island, Fuegia, and from the Marion Islands, the latter record being perhaps doubtful. This distribution may possibly be held to support the idea of a land connection with the antarctic distinct from, and, if so, probably subsequent to, the land connection through Tasmania by which probably the greater part of the mosses common to the two regions reached New Zealand.

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* "Ludwig" is a misprint for "Hedwig" in the Handbook, copied by R. Brown.

EXPLANATION OF PLATES.

PLATE V.

Fig. 1. *Pleuridium longirostre* (type). *a*, *a′*, plant, × 4. *b*, upper stem leaf, × 20. *c*, perichaetial leaf, × 20. *d*, upper cells, × 200. *e*, median cells of basal part, × 200.

Fig. 2. *P. Arnoldii* (Dunedin; Petrie). *a*, *a′*, plant, × 4.

Fig. 3. *Ditrichum elongatum* (Otago; Petrie). *a*, *a′*, capsule, × 4. *b*, peristome, × 100.

Fig. 4. *D. strictum*. *a*, *a′*, capsule, × 4 (Weir, Musci Novae-Granatenses, 174). *b*, leaf-base, × 20. *c*, cells of shoulder, × 200 (Lord Auckland Islands, 57 and 58, Herb. Hooker.).

Fig. 5. *D. punctulatum*. *a*, *a′*, capsule, × 4. *b*, peristome, × 100 (Wairarapa; Gray). *c*, leaf-base, × 20. *d*, cells of shoulder (N.Z.; Lyall, in Herb. Hooker.).

Fig. 6. *Distichium capillaceum*. *a*, *a′*, capsule, × 4.

Fig. 7. *Ditrichum calcareum* (type). *a*, stem, nat. size. *b*, *b′*, stem-leaves, × 20. *c*, upper cells, × 200.

Fig. 8. *D. brevirostrum* (type). *a*, plant, nat. size. *b*, *b′*, stem-leaves, × 20.

Fig. 9. *D. blindioides* (herb. C. Müller). *a*, stem, nat. size. *b*, leaf, × 20. *c*, leaf-base, × 20. *d*, upper cells, × 200.

Fig. 10. *Pseudodistichum Buchanani* (type). *a*, leaf, × 20. *b*, cells of base, × 100. *c*, leaf-apex, × 25. *d*, upper cells, × 200. *e*, *e′*, capsules, × 4.

Fig. 11. *Ps. Brotherusii* (type). *a*, leaf-apex, × 25. *b*, upper cells, × 200. *c*, *c′*, capsules, × 4.

PLATE VI.

Fig. 12. *Seligeria Cardotii* (type, as *Blindia calcarea*). *a*, *a′*, plant, × 4. *b*, leaves, × 20. *c*, upper cells, × 200.

Fig. 13. *Blindia tenuifolia* (Mount Thompson; Brown). *a*, leaf, × 20. *b*, upper cells, × 200.

Fig. 14. *B. magellanica* (New Zealand; Colenso). *a*, plant, nat. size. *b*, capsule and perichaetium, × 8. *c*, dry capsule, × 12. *d*, leaf, × 20. *e*, upper cells, × 200.

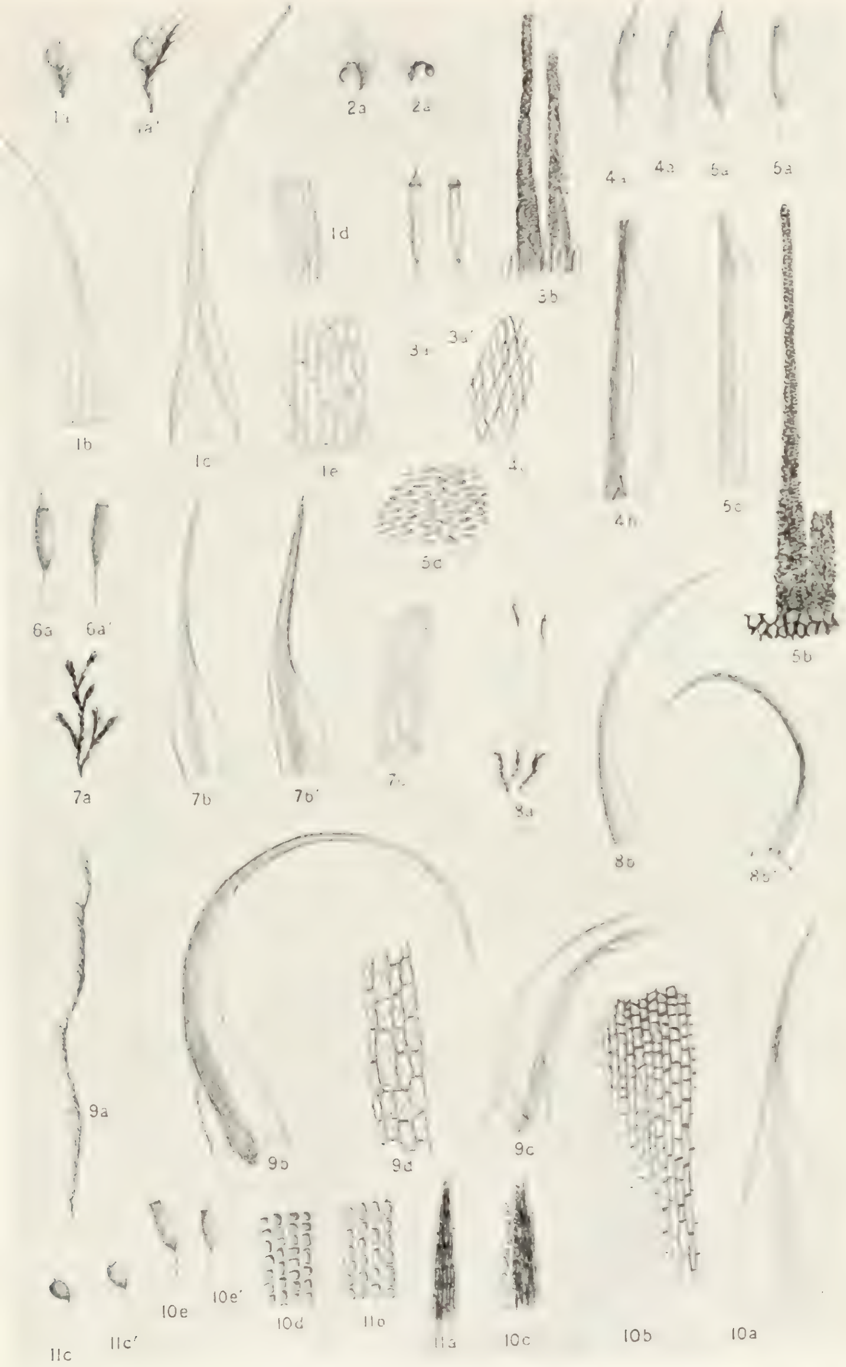
Fig. 15. *Dicranella wairarapensis* (type). *a*, plant. *b*, ♂ stem, nat. size. *c* *c′*, leaves, × 20. *d*, upper cells, × 200. *e*, part of subula, × 100. *f*, *f′*, capsule, × 4. *g*, peristome, × 100.

Fig. 16. *D. cyrtodonta* (type; herb. C. Müller). *a*, *a′*, stem, nat. size. *b*, stem-leaf, × 20. *c*, upper cells, × 200. *d*, upper cells of branch leaf, × 200. *e*, perichaetial leaf, × 20. *f*, capsule, × 4. *g*, peristome teeth (imperfect), × 100.

Fig. 17. *Campylopodium euphorocladum* (Rotorua, Auckland; Petrie). *a*, leaf, × 20. *b*, upper cells, × 200.

Fig. 18. *C. lineare* (Wellington; Petrie). *a*, leaf, × 20. *b*, upper cells, × 200.

PLATE V.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H. N. Dixon del.

West, Newman, proc.

Face p. 74

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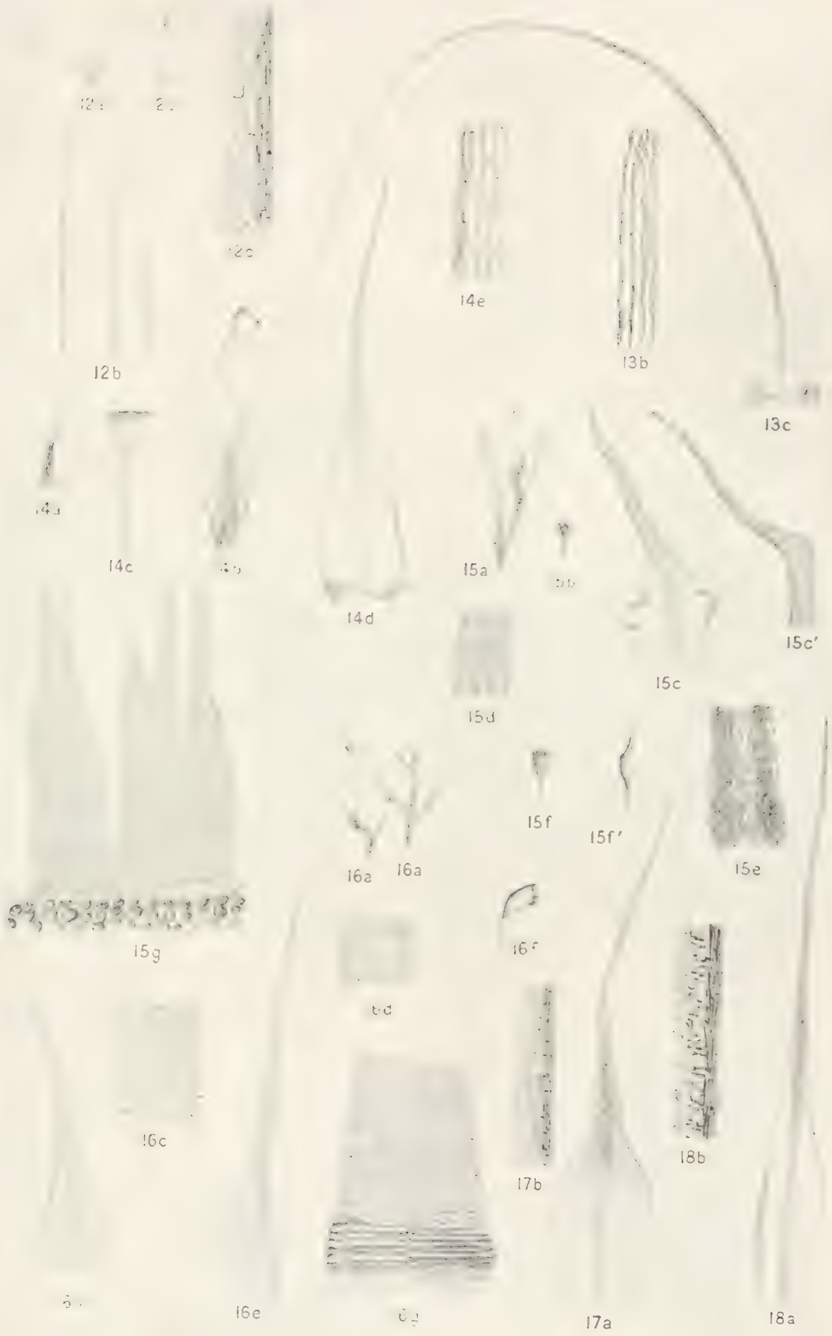
PLATE VI.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H. N. Dixon del.

West, Newman, proc.

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NEW ZEALAND INSTITUTE.

BULLETIN No. 3.

STUDIES IN THE

BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF ROBERT BROWN,
OF CHRISTCHURCH, NEW ZEALAND.

BY H. N. DIXON, M.A., F.L.S.

PART III.

EDITED AND PUBLISHED UNDER THE AUTHORITY OF THE BOARD OF
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PART III.

Plates VII and VIII.

Since the publication of Part II the outbreak of war in Europe has seriously interfered, in more than one respect, with the carrying-out of these studies. One of my primary objects has been to clear up the position of a number of New Zealand species created by C. Müller, either described by him in the "Symbolae ad Bryologiam Australiae" (Hedwigia, 1897–98), or cited as unpublished names in the "Genera Muscorum Frondosorum." The unhappy state of hostility between the nations has rendered it impossible to obtain from Berlin some of the specimens in C. Müller's herbarium which are necessary in order to determine their true position. Fortunately, some of those with which this instalment is concerned had been kindly loaned to me before the outbreak of hostilities, and for these I have to express my indebtedness to the authorities of the Berlin Museum; but in a few cases this was not possible, and I have been obliged to form my opinions—of necessity inconclusive—from the descriptions alone. If these have been for the most part unfavourable to the validity of the species, it is because they date in nearly all cases from a late period in C. Müller's life, when his critical faculty had without question become impaired; and will not, I trust, be held to cast any slur on the immense contributions to botanical science made by this great bryologist during the course of his life.

On the other hand, further and very welcome light has been thrown on Brown's plants by the kindness of Mr. G. Brown, son of R. Brown. The earlier parts of this bulletin having come under his notice, Mr. G. Brown wrote informing me that the bulk of his father's collection remained in his hands, though some parts had unfortunately perished. Subsequently he kindly sent me specimens of all that he could find of R. Brown's published and unpublished species, as well as a large amount of unnamed material; and these have been of inestimable value, embracing as they do a large number of types of species not represented in the Christchurch Museum collection.

Before continuing the further study of the Dicranaceae I wish to make one or two additions and corrections to Parts I and II.

Part I, p. 12.—To the synonymy of *Dicranoloma Menziesii* add "*Leucoloma calymperoideum* C. M. in Hedw., xxxvi (1897), p. 359." I have received part of the type material from the Berlin Museum, and find that it is quite identical with this species.

Part I, p. 19.—*Dicranoloma chrysodrepaneum*. Further material tends to diminish the distance between this and *D. robustum*. The leaf subula is often more sharply denticulate than indicated in the description. The pale border may be scarcely distinct (and specimens of *D. robustum* sometimes show an equally defined border); and altogether the validity of the species appears very dubious. The setae are generally single in each perichaetium.

Part II, p. 55.—After *Seligeria Cardotii*—

Seligeria diminuta (R. Br. ter.) Dixon comb. nov.

Syn. *Grimmia diminuta* R. Br. ter. in Trans. N.Z. Inst., vol. 27 (1894), p. 417, t. 33.

The original gathering of *Grimmia diminuta* (limestone rocks near Castle Hill, Christchurch, Mar., 1891; coll. R. Brown) proves to be a *Seligeria*. It differs at once from *S. Cardotii* with which it was growing —in the leaves, which are much wider, and shorter in the acumen, not finely setaceous as in that species; in the seta, which is strongly curved and cygneous (in *S. Cardotii* it is at most slightly curved only); and very markedly in the form and structure of the capsule. This in *S. Cardotii* when deoperculate is about 0·5 mm. long, of equal width, turbinate, and tapering gradually into the seta; in the present species it is appreciably larger, not turbinate but subglobose (the widest part being at mid-capsule, not at the mouth), and the texture is entirely different. The upper exothecium cells in *S. Cardotii* are small, irregular, remarkably incrassate with yellowish walls, the lumen in fact being often but little wider than the cell-wall; one or two rows at orifice being transversely rectangular, but not much altered in size or colour. In *S. diminuta* the upper cells are about four times as large, with soft, not much incrassate, concolorous walls, with three or four rows at orifice much smaller, highly incrassate, of a deep red-brown.

Brown's figures, so far as they go, give a good idea of the plant, but the leaves are drawn a little too broad in the acumen.

Part II, pp. 57, 59.—I have given *Blindia Wellingtonii* C. M. as a synonym of *B. tenuifolia*; but Mr. Weymouth has recently written that this is not the case. *B. Wellingtonii* C. M. MS. was founded on Weymouth's No. 492, which is *Blindia ferruginea* (Mitt.) Broth. (syn. *Leptotrichum ferrugineum* Mitt. in H. f. & W. Fl. Tasm., ii. 171).

Part II, p. 64.—In the synonymy of *Dicranella clathrata* for "*Dicranum Cardotii*" read "*D. Cockaynii.*"

I have received a specimen from the Berlin Museum labelled "*Dichodontium Cockaynii* Broth.: Little Kowai R., Mt. Torlesse: coll. Beckett," which is identical with my *Dicranella wairarapensis*, but there is nothing to show that this either is or is intended to be synonymous with *Dicranum Cockaynii* R. Br. ter. No specimens of that are to be found in Brown's herbarium, and it is better to let the name drop as a probable synonym of *D. clathrata.*

Part II, p. 65.—**Dicranella wairarapensis** Dixon.

The following particulars as to the habitat of this moss, from a letter of Mr. Gray's, may be of interest: "The overlying rock here is a shelly limestone; this has been broken, and carried up in many places to the crests of the hills; the underlying stratum is thus exposed on the hillsides, and is a hard blue marl, known throughout the colony as 'papa.' It is on bare faces of this 'papa' that the *Dicranella* is found."

I have received part of the type specimen of *Dicranum Cardotii* R. Br. ter., which proves to be identical with my *Dicranella wairarapensis*, and must therefore replace that name. The species will stand thus:—

Dicranella Cardotii (R. Br. ter.) Dixon comb. nov.

Syn. *Dicranum Cardotii* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 329, t. 36 (1902). *Dicranella wairarapensis* Dixon in Bull. N.Z. Inst., No. 3, p. 65 (1914).

Part II, p. 66.—For "*Dicranella Jamesonii* (Mitt.) Broth." read "*D. Jamesonii* (Tayl.) Broth."

Part II, p. 69, under "Incertae sedis"—*Dicranum Gulliveri* proves to be *Eucladium irroratum*; and *D. lanceifolium* is not *Tridontium*, but *Weisia Weymouthii.*

Campylopodium euphorocladum (C. M.) Besch.

To the synonymy of this species (p. 70) add: "*Campylopus Gulliverii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 472, t. xxxvii (1896). *C. arenarius* R. Br. ter., *op cit.*, p. 475, t. xxxviii, *pro parte.*"

C. Gulliverii in Brown's herbarium is a very tall form of *Campylopodium euphorocladum*, 1½–2 in. high. I have received the same form from Rev. C. H. Binstead, gathered in New Zealand by T. G. Wright, as "*Campylopus flexuosus.*"

C. arenarius is represented by a tuft containing two or three species, including *C. clavatus* R. Br., and *Campylopodium euphorocladum.*

Campylopodium lineare (Mitt.) Dixon.

A specimen from Mitten's herbarium, "N.Z., Hutton & Kirk, 306," is this species.

Dichodontium (Pt. II, p. 72).

I had overlooked, in stating that *Dichodontium* was unrepresented in Australia, the publication of *D. Wattsii* Broth. (in Proc. Linn. Soc. N.S.W. (1912), xxxvii, 366). That plant, however, a specimen of which I have received through the kindness of Rev. W. W. Watts, is, in my opinion, not a *Dichodontium*, but a *Dicranella* extremely near to and possibly identical with my *Dicranella wairarapensis*, as to the generic position of which—near *D. clathrata*, &c.—there can, I think, scarcely be a doubt. The Australian plant has not been found in fruit.

DICRANACEAE—*continued.*

HOLOMITRIUM Brid., Bryol. univ., i, 226 (1826).

1. **Holomitrium perichaetiale** (Hook.) Brid., *op. cit.*, p. 227.

> Syn. *Trichostomum perichaetiale* Hook., Musc. Exot., i, t. 73, et ii, p. 11 (1818–20). *Symblepharis perichaetialis* Wils. in Fl. N.Z., ii, 60 (1855); Handb. N.Z. Fl., p. 405. *Holomitrium nanum* Hampe in C. M. Gen. Musc. Fr., p. 254 (*nomen*). *Trichostomum Moretonii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 483, t. xl (1896).

I have carefully examined the specimen of *H. nanum* in Hampe's herbarium, labelled "56. New Zealand. *Holomitrium nanum* Hpe. ? *Symblepharis perichaetialis* Wils." It is described as differing from *H. Mülleri*, "Statura minore, foliis brevioribus e basi oblongo-cuneata plano-carinato-lanceolatis margine erecto parce cucullatis, nervo angustiore versus apicem evanescente (nec folia nervo crasso percursa cuspidata)." The difference of nerve and leaf-apex is not, however, sufficient to justify specific rank, for on specimens of *H. perichaetiale*, "W. 4, Campbell's I., Hb. Hook.," I find leaves of the normal type side by side with—quite as frequently—others with the type described for *H. nanum*, and scarcely differing from the actual leaves of that plant. I may add that neither *H. Hodgkinsoniae* C. M. nor *H. Mülleri* Hampe appears to me separable from the widely distributed *H. perichaetiale*, which is a highly variable plant; the stems as well as the setae vary prodigiously in length; the leaves may on the same stem be very acute and longly hyaline-apiculate, or subobtuse and barely apiculate.

Trichostomum Moretonii, in R. Brown's herbarium, is without any doubt also referable here.

EXCLUDED SPECIES.

Holomitrium undulatulum C. M. in Hedw., xxxvi, 1897, p. 365. Original specimens of this plant ex herb. C. Müller show it to be inseparable from *Mesotus celatus* Mitt.

Holomitrium pumilum Mitt., MSS. (Par., Ind., ed. ii, 316), is without doubt based on a slip (*cf. Dicranum pumilum* Mitt. *infra*).

BRAUNFELSIA Par., Ind. bryol, p. 148 (1894).

Braunfelsia obesifolia (R. Br. ter.) Dixon comb. nov.

Syn. *Dicranum* (?) *obesifolium* R. Br. ter. in Trans N.Z. Inst., vol. 29. p. 462, t. 34 (1896). *Eucamptodon Petriei* Broth. in Oefv. af Finska Vet. Soc. Foerh., xl (1898), p. 161. *Braunfelsia Petriei* Broth. in Engler and Prantl, Musci, p. 321 (1901).

This very remarkable and fine plant has, so far as I am aware, not been gathered outside the Province of Westland, where it was collected by D. Petrie in the Teremakau Valley (and subsequently in the Otira Valley), and independently by R. Brown in two stations on Kelly's Hill. R. Brown published his plant in the Transactions as *Dicranum* (?) *obesifolium*. The specimen in his herbarium figures as *D.* (?) *obesum*. It is a taller and even finer plant than Petrie's specimens, with larger, slightly more distant leaves, but is indisputably the same thing, and Brown's name must replace that of Brotherus.

Brotherus in his original description of *Eucamptodon Petriei* states that the fruit is unknown: but in a specimen sent me by Mr. Petrie, gathered in the Otira Valley, Westland, there is a single overripe, old, and deoperculate capsule. The perichaetium is elongate, about 1 cm. long, convolute and subtubular, the innermost bracts subobtuse. (The uppermost leaves of the stems also are very closely convolute, forming terete cuspidate points closely similar to the perichaetia.) The seta is, with the capsule, 2 cm. long, red, erect, stout, gradually enlarged above to the neck of the capsule, where it is (probably abnormally) deeply channelled on one side; the capsule is 3 mm long, stout, erect or suberect, subcylindrical, rather pachydermatous, somewhat narrowed below the mouth, with fragments of a peristome.

B. obesifolia has the aspect of a robust *Dicranum*, with large, rather shining, smooth, golden-brown, straight broad leaves, which are actually obtuse and rounded, but being highly concave, with the margins strongly enrolled to apex, they appear pointed. R. Brown's figures give a good idea of their general appearance. Apart from the colour it much resembles large forms of *Campylopus Kirkii* at first sight.

(DICRANOLOMA Renauld. Already treated in Part I.)

DICNEMOLOMA Ren. in Rev. bryol., 1901, p. 86.

Internal cells of lamina extending to the base, only the lowest juxtacostal ones elongate; hyaline border narrow, conspicuous; leaves frequently hair-pointed. Habit peculiar, not dicranoid. Peristome-teeth divided in the upper part only.

KEY TO THE SPECIES.

Stems slender, elongate, flexuose, more or less prostrate, usually pale below; hair-point often wanting on many leaves, in others very fine, hyaline, short, flexuose .. .. 1. *Sieberianum*
Stems more robust, short, scarcely flexuose, more or less erect, dark brown below.
Leaves usually all ending in a longer, much stouter, yellowish hair-point 2. *incanum.*

There is entire confusion in the "Handbook of the New Zealand Flora" about *D. incanum*, where it is cited as "*Dicranum incanum* Mitt. MSS. (*Leucoloma*)." The only locality given for it there is "Northern Island, Sinclair." And the plant is described as differing from *D. Sieberianum* in having all the leaves acuminate and not piliferous, except the perichaetial leaves, with some slight differences in the seta and fruit But Sinclair's plant is only *D. Sieberianum*, and was not considered by Mitten to belong to his *L. incanum* at all. The only two plants in his herbarium, as Mrs. Britton informs me, under the cover of *L. incanum*, are "*D. Sieberianum* β of the Fl. of N.Z.; New Zealand, Dr. Hooker," and "No. 72, Hutton and Kirk; Gt. Barrier Id., N.Z.," the latter being unnamed. Sinclair's New Zealand plant is included in Mitten's herbarium under *Sclerodontium Sieberianum*, and it is due to some misunderstanding that it is cited in the Handbook under *D. incanum*. It would appear that Hooker misunderstood the application of Mitten's name, having got it attached, by some mistake, to Sinclair's specimen, and then drew up his own description of it from that plant. The absence of hair-points from most of the leaves is, however, a frequent character in *D. Sieberianum*, while the fruiting characters as given are equally applicable to that species. It may also be remarked that *incanum* would be a peculiar name to give to a species which was distinguished principally by the absence of hair-points!

Hooker's own specimen, however, and Hutton and Kirk, No. 72, are of quite a different aspect, colour, and habit, and Hooker's plant is very marked in the character of the hair-point. Hutton and Kirk's 72, however, with the habit of Hooker's specimen, has the hair-point very short and scarcely developed. It is therefore intermediate between *D. Sieberianum* and *D. incanum*, and I am inclined to think it may ultimately be found that *D. incanum* is rather to be retained as a varietal form of *D. Sieberianum* than of specific rank.

1. **Dicnemoloma Sieberianum** (Hornsch.) Ren., Essai sur les *Leucoloma*, p. 44 (1909).

Syn. *Dicranum Sieberianum* Hornsch. in Sieber M. Nov. Holl., n. 16, *e* C. M., Syn., 1, 352 (1849); Handb. N.Z. Fl., p. 410. *Leucodon pallidus* Hook., Musc. Exot., ii, t. 172 (1820). *Sclerodontium pallidum* Schwaegr., Suppl. ii, Pt. i, p. 124, t. 134 (1823). *Dicranum incanum* Hook. f., Handb. N.Z. Fl., p. 410 (*nec L. incanum* Mitt.).

Distrib.—New Zealand, North Island; Tasmania; Australia.

2. **Dicnemoloma incanum** (Mitt.) Ren., *op. et loc. cit.*

Syn. *Dicranum Sieberianum* var. β, H. f. & W., Fl. N.Z., ii, 67. *Leucoloma incanum* Mitt., MS. in herb.

Distrib.—New Zealand, North Island.

According to Paris, *D. Sieberianum* is lignicolous, while *D. incanum* is a plant of wet rocks.

DICRANUM Hedw., Fund. ii, 91 (1782).

KEY TO THE SPECIES.

1.	Plant tall, robust, 1–2 in. high; leaves 5–8 mm.; seta long, 1·5–2·5 cm.; capsule 3–4 mm. long. Peristome-teeth irregularly divided above, often coherent below	4. *trichopodum.*
	Plants small, rarely more than 1 in. high; leaves small, 3–5 mm.; seta short, scarcely more than 1 cm., often much less; capsule minute, 1–2 mm. long without lid. Peristome-teeth entire or scarcely split at extreme tip only	2. (Subgenus *Holodontium*)
2.	Leaves crisped when dry, capsule on a very short flexuose seta, scarcely emergent..	1. *Mackayi.*
	Leaves scarcely altered when dry, seta longer, erect	3
3.	Leaf-apex flattened, and remaining appreciably widened to the point; upper cells 2–4 × 1 or shorter	2. *pumilum.*
	Leaf-apex very finely subulate, acute, upper cells mostly elongate	3. *aucklandicum.*

Subgen. HOLODONTIUM Mitt.

1. **Dicranum Mackayi** Broth. and Dixon in Journ. Linn. Soc. (Bot.). xl, 437, tab. 20 (1912).

For this species the student may be referred to the original description, *op. cit.* It is quite distinct from all the remaining species in the very short seta, minute oval capsule, and leaves curled when dry. It forms, in fact, with one or two South American species, a transition to *Dicranoweisia*. Indeed, *D. antarctica* is scarcely distinguishable by the leaf-structure alone; but the leaves in *D. Mackayi* are markedly falcato-secund when moist, and the fruit is quite different.

Hab.—Nun's Veil Mount, Mount Cook district, 6,000 ft.; 1907. Jas. Murray.

2. **Dicranum pumilum** Mitt. in Journ. Linn. Soc., Bot., xii. p. 64 (1869).

Syn. *Symblepharis pumila* Hook. f., Handb. N.Z. Fl., p. 405 (1867).
Holomitrium pumilum Par., Ind. bryol. (1894).

The history of the above synonymy is most obscure. Mitten in 1869 published his *Dicranum* (§ *Holodontium*) *pumilum*, "Fuegia, Hermite I., J. D. Hooker." He makes no mention there of its having been found in New Zealand. Nor has *Dicranum pumilum* Mitt. been recognized as a New Zealand species in any work with which I am acquainted. All authors treat the New Zealand plant as a different thing altogether. And yet not only is Hector's New Zealand plant actually identical with the Hermite Island species, but it figures as *Dicranum pumilum* Mitt. both in Mitten's herbarium and in Hooker's herbarium at Kew. Mitten, I think one may say certainly, never intended it to be placed under *Symblepharis* or *Holomitrium*. I am inclined to suggest that in his MS. notes he gave his opinion that the name *Holomitrium* should be retained instead of *Symblepharis*; and that elsewhere he may have written *H. pumilum* and *H. antarcticum*, intending *Holodontium*, not *Holomitrium*. Hooker, *loc. cit.*, cites Mitten as saying that the New Zealand plant in question is "allied to *H. antarcticum* C. M." Now, *Dicranoweisia antarctica* (C. M.) has never been treated as a *Holomitrium* or *Symblepharis*, and, whatever Mitten wrote, it is in the highest degree unlikely that he thought of either *D. antarctica* or the New Zealand *D. pumilum* as a *Holomitrium*. Mitten must be conceded to have understood the relationships of *D. pumilum* clearly, and cannot be held responsible for the nomenclature of the Handbook. It still remains a puzzle, however, why in describing his *D. pumilum* in the M. Austr.-am. he omitted all reference to the New Zealand plant.

The locality of the latter in Mitten's herbarium is given as "Dry ground, Otago; Hector; 10; 1863." It has not been found since.

Subgen. TRICHODONTIUM Dixon.

3. **Dicranum aucklandicum** Dixon in Bull. Torr. Bot. Club, xlii. 94 (1915).

Syn. *Trichostomum falcatum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 480 (1897).

This quite-recently-described species was found in Mitten's herbarium under the same cover with *D. pumilum*, no other data being given but "Auckland Island, New Zealand." It is a less densely tufted, more laxly foliate plant than *D. pumilum*, which it much resembles; the leaves also are longer, more finely tapering, with more elongate upper areolation. The sporophyte is very similar, but the peristome-teeth are almost entirely destroyed.

Since the publication of the species, however, further material has become available from Brown's herbarium. A specimen labelled "*Dicranum*; dioecious; Flagstaff Hill, Dunedin, Jan., 1889; conglomerate rocks in crevices." coll. W. Bell, is in good fruiting-condition. The peristome-teeth are moderately short (about 0·25 mm.), finely divided above into two filiform, often unequal crura; deep red at base, and here not or scarcely striolate, but densely and finely papillose; the crura much paler, strongly coarsely papillose. Annulus highly developed, persistent. Lid finely subulate, about equalling the capsule.

The peristome-teeth, not or scarcely striolate at base, but papillose throughout, bring this moss very close to *Dicranoweisia*. In form, however, they are dicranoid, and the leaf character and structure is entirely that of *Dicranum*, as is the highly developed annulus; and these characters must outweigh the single one of the non-striation of the peristome. On the other hand, the divided teeth preclude its being placed under the subgenus *Holodontium*, and the inflorescence, which appears to be dioicous, would also remove it from that section. I propose, therefore, for it the new subgenus *Trichodontium*, having the principal characters of *Holodontium* but differing in the finely bifid, papillose peristome-teeth, and probably in the dioicous inflorescence.

Further localities are "Summit of Kelly's Hill, West Coast Road, Feb., 1883," and "Damp ground, South Fiord, Lake Te Anau, Dec., 1889"; both collected by R. Brown.

Subgen. LEIODICRANUM Limpr.

4. Dicranum trichopodum Mitt. *apud* Hook. f., Handb. N.Z. Fl., p. 411 (1867).

Syn. *Dicranum pulvinatum* C. M. in Hedw., xxxvi (1897), p. 363.
Trichostomum Hallii R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 482, t. xl (1896).

This well-marked species is aptly described by Mitten as having the foliage of *Dicranoloma setosum* and the capsule of *Holomitrium perichaetiale*. The capsule mouth is narrowed, and the peristome—for a *Dicranum* of this subgenus—small and irregular. The perichaetium is very long and sheathing, the innermost bract convolute, abruptly terminating in a rather long setaceous arista.

It is recorded in the "Handbook of the New Zealand Flora" from only one station, "Middle Island, Otago; Hector and Buchanan." I have it also from Paparoa Range, 1888, R. Helms (the same plant which C. Müller described as *Dicranum pulvinatum* sp. n.); and from Clinton Valley, Te Anau, collected and sent by D. Petrie. There is a single specimen at Kew, "Westland, Teremakau; Beckett"; and none at all in the British Museum collection. It would appear to be a rare plant. It occurs in R. Brown's herbarium as *Trichostomum Hallii* sp. nov., collected by Brown by Lake Te Anau, on decaying wood, in 1890. A further interesting extension of its range is given by a specimen in Mitten's herbarium under the MS. name of "*Holomitrium Milligani*: on half-rotten limbs and trunks of trees in dense forest, Gordon River, Tasmania; Dr. Milligan; 790. Nov., 1846," which is quite identical with the New Zealand *D. trichopodum*. I have also received a Tasmanian specimen recently collected by Mr. L. Rodway (No. 1705).

EXCLUDED SPECIES.

Handb. N.Z. Fl. :—
D. Billardieri = *Dicranoloma.*
D. dicarpum = *Dicranoloma.*
D. fasciatum = *Dicranoloma.*
D. Menziesii = *Dicranoloma.*
D. robustum = *Dicranoloma.*
D. setosum = *Dicranoloma.*
D. Sieberianum = *Dicnemonoloma.*
D. incanum = *Dicnemonoloma.*
D. tasmanicum = *Tridontium.*
D. clathratum = *Dicranella.*
D. Schreberi = *Dicranella Jamesonii.*
D. campylophyllum = *Dicranella Jamesonii p.p.*; *D. clathrata p.p.*
D. dichotomum P. Beauv. = *Dicranoloma Billardieri* (*cf.* Journ. of Bot., 1916, p. 356).

R. Br. ter. :—
D. pygmaeum = *Dicranella gracillima.*
D. pusillum = *Dicranella gracillima.*
D. variabile = *Dicranella clathrata.*
D. Cockaynii = *Dicranella clathrata.*
D. papillosum = ? *Dicranella clathrata.*
D. subulatifolium = ? *Dicranella clathrata.*
D. clintonensis = *Dicranella clathrata.*
D. Cardotii = *Dicranella.*
D. waimakaririense = ? *Dicranella Jamesonii.*
D. debilum = *Dicranella* sp.
D. erecto-thecum = *Dicranella* sp.
D. fulvum = *Dicranoloma Menziesii.*
D. Speightii (See *Dicranoloma*, Part i, p. 28.)
D. obesifolium = *Braunfelsia.*
D. lancifolium = *Weisia Weymouthii* var. *lancifolia.*
D. Kowaiense = *Weisia Weymouthii* var. *lancifolia.*
D. rostratum = *Tridontium tasmanicum.*
D. Gulliverii = *Eucladium irroratum.*
D. rupestre = *Blindia tenuifolia.*
D. collinum = *Blindia tenuifolia.*

D. debilum R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 456, and *D. craigieburnensis* R. Br. ter., *op. cit.*, p. 457, unfortunately do not appear in Brown's herbarium, and the descriptions and figures are insufficient to indicate their position. The latter is almost certainly a *Dicranella.*

CAMPYLOPUS Brid., Mant., p. 71 (1819)

Some thirty-five or more species of New Zealand *Campylopus* have been described at one time or another. The following treatment of the genus, tentative only, reduces them to less than a dozen, and I must frankly admit that I am far from clear as to the validity of some of these. The forms intergrade so frequently, and the distinguishing characters are often so elusive, that a close study of the plants in the field can alone be hoped to solve some of the problems involved.

The presence or absence of a hair-point to the leaves is usually considered an important character, and might be supposed to afford a simple test; yet in two or three species I find it exceedingly difficult to know whether they should be placed in the section Atrichi or in Trichophylli! The width of the nerve is a valuable feature, but within certain limits it may vary considerably, as between different leaves of the same stem. The alar cells may form well-defined auricles or may be quite absent; but, on the other hand, they may be so indeterminate that it is difficult to know how to class the leaf. And again, the habit of the plant may vary immensely, and it becomes very difficult at times to know how much weight to place upon this character. That the plants are for the most part found sterile is of the less consequence since the fruit rarely gives any distinctive characters of value. This being the case, it is most difficult to draw up a satisfactory key. The following attempt may, however, be of some practical help.

R. Brown has described fifteen new species of *Campylopus* in Trans. N.Z. Inst., vol. 29; but none of these can stand. This is to be explained, no doubt, by the fact that with Brown it was the habit and morphological characters that counted, rather than the structural and microscopical; and in *Campylopus* differences in habit, colour, &c., really stand for very little. This is well exemplified in his descriptions of new species of this genus: throughout the whole there is no reference to the alar cells; the description of the areolation is, indeed, confined to "oblong," "small, linear," "quadrate," when it is mentioned at all, and the nerve is uncompromisingly either "broad" or "narrow." Most of these species are preserved in his herbarium, and unfortunately they can all, to a certainty be referred to one or other of the described species.

KEY TO THE SPECIES.

Subgenus I. CAMPYLOPUS sensu stricto Limpr.

Nerve (in section) with dorsal stereids only, the cells above the Deuter series being in one row only, lax, and often considerably larger than the Deuter cells.

A. ATRICHI. Leaves not ending in a distinct hyaline point. (*C. capillatus* and *C. torquatus* may have the tip of the subula colourless or hyaline.)

1. Leaf-apex capillary.
    a. Calyptra entire at base.
        * Supra-alar cells wide and short; nerve about half width of base 1. *Holomitrium.*
        ** Supra-alar cells linear; nerve about one-third width of base or less 11. *nudus.*
    b. Calyptra fringed at base.
        * Stem tall, interruptedly comose; alar cells fairly well marked 3. *capillatus.*
        ** Stem rarely more than 1–1½ in. high, scarcely comose; alar cells none 2. *torquatus.*

2. Leaf subula rigid, not capillary, usually ending abruptly and subcucullate (rarely with a short hair).
    a. Nerve much more than half width of base, alar cells inconspicuous 4. *bicolor.*
    b. Nerve less than half width of base, alar cells large .. .. 5. *Kirkii.*

B. TRICHOPHYLLI. Some leaves, especially the comal, ending in a distinct hyaline hair-point.

1. Hair-point abruptly reflexed.
    - *a.* Nerve nearly smooth at back .. .. 9* *pudicus.*
    - *b.* Back of nerve with alternate ridges and furrows (best seen in section) 9. *introflexus.*
2. Hair-point not abruptly reflexed.
    - *a.* Nerve half width of leaf-base or more, usually; hair-point short.
        - * Alar cells large, supra-alar all rectangular, leaves rather shortly tapering; nerve $\frac{2}{5}$–$\frac{3}{5}$ width of base .. .. .. 6. *clavatus.*
        - ** Alar cells inconspicuous; nerve $\frac{3}{5}$–$\frac{4}{5}$ width of base 4. *bicolor* var.
    - *b.* Nerve usually less than half width of leaf-base. Hair-point often long.
        - * Alar cells large, supra-alar rectangular, leaves longly tapering 8. [illegible]
        - ** Alar cells indistinct, supra-alar next nerve soon becoming obliquely rhomboid, marginal very thin and narrow, forming a hyaline band passing obliquely upward .. .. .. 7. *insititius.*

Subgenus II. PALINOCRASPIS Lindb.

Nerve-section with median Deuter and both ventral and dorsal stereid bands 10. *arboricola.*

Subgen. CAMPYLOPUS.

A. Atrichi.

1. Campylopus Holomitrium (C. M.) Jaeg., Adumbr. i. 135 (1870–71). [Plate VII, fig. 7.]

> Syn. *Dicranum Holomitrium* C. M., Syn. i. 389 (1848). *Campylopus capillaceus* H. f. & W. in Lond. Journ. Bot., 1844, p. 543 (*nec C. capillaceus* (Brid.) Jaeg., Adumbr. ii, 429). *Dicranum distractum* C. M. in Hedw., xxxvi (1897), p. 350. *Campylopus distractus* Par., Ind. Suppl., p. 91. *Campylopus lonchochaete* C. M. in Abhandl. d. Natur. Ver. Bremen, 1900, p. 495.

I have examined the types of C. Müller's *Dicranum distractum* and *C. lonchochaete*, and have no hesitation in referring them here, although both are without calyptra, and there is no opportunity of verifying the entire base, one of the most important structural characters of the species. I find no such difference in areolation between the two as C. M. describes under *C. lonchochaete*.

This species is omitted from the "Handbook of the New Zealand Flora," no doubt by an oversight. It is a good species, which, apart from the sporophytic characters, may be recognized by the flexuose, finely setaceous leaves, which are usually rather distant, and by the character of the leaf-base, which, however, is somewhat difficult to define; the broad nerve, the alar cells usually highly coloured (or hyaline) and numerous, but not greatly enlarged, and especially the supra-alar cells remaining *short* and *wide* (irregularly quadrate, &c.), practically to the base, particularly contribute to this characteristic appearance of the leaf-base (*cf.* Plate VII, fig. 7).

C. Holomitrium is probably one of the more uncommon species; in fact, apart from the original Bay of Islands gathering by Sir J. D. Hooker, all the specimens I have seen have come from the volcanic district of Taupo, in the North Island, excepting that of *C. distractus* C. M., the place of origin of which is unknown. C. Müller, by the way, redescribed this plant as *C. distractus* in the same publication as *C. lonchochaete*, forgetful of the fact that he had already published it as *Dicranum distractum* in the Symbolae.

2. **Campylopus torquatus** Mitt. in Fl. Tasm., p. 173 (1860); Handb. N.Z. Fl., p. 414.

Syn. *Dicranum torquatum* Mitt. in Journ. Linn. Soc., Bot., iv (1859), p. 69. *Campylopus pallidus* H. f. & W., Fl. N.Z., ii, 68, t. 84, *p.p.* (1855). *C. torfaceus* Mitt. in Kew Journ. Bot., 1856, p. 257 (*nec C. torfaceus* B. & S.). *C. Sparksii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 467, t. 35 (1896). *C. ohingaitii* R. Br. ter., *op cit.*, p. 470, t. 37. [This is the plant cited by Hampe as *Dicranum flexuosum* Hedw. in Linn., xxviii (1856), 207, as well as by other authors, but is not Hedwig's plant.]

C. torquatus is perhaps the most abundant New Zealand species of the genus, and one of the most variable. The short silky stems which are not comose at the perichaetia make it fairly easy to recognize at once in the field from all but perhaps *C. capillatus.* It is usually an abundant fruiter. The leaves end in a long delicate capillary flexuose subula, which becomes colourless and frequently distinctly hyaline at the extreme apex, but scarcely so as to justify its being placed among the Trichophylli. The short base, wide nerve, and lax rectangular hyaline basal areolation, entirely without distinct alar cells, also make it easy of recognition.

3. **Campylopus capillatus** H. f. & W., Fl. Tasm., ii. 172, t. 172 (1860).

Syn. *C. Bellii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 469, t. 36. *Dicranum glauco-viridis* C. M. in Hedw., xxxvi (1897), p. 350. *Campylopus glauco-viridis* Par., Ind. Suppl., p. 92 (1900).

The type of *C. glauco-viridis* (C. M.), "New Zealand, Sunday I., 1888, *leg.* Cheeseman," is certainly *C. capillatus.* R. Brown's *C. Bellii* is a small form, exactly agreeing with *C. torquatus* in habit, and scarcely to be distinguished from it except by the presence of distinct alar cells.

C. capillatus is, indeed, very close to *C. torquatus*, and structurally scarcely separable except by the presence of the clearly differentiated though not very conspicuous auricles; the leaves are rather larger, the leaf-base perhaps usually rather longer, and the stems are tall (up to 3 in.), with the upper leaves markedly comose, the whole plant stouter and less silky. It is also near to *C. appressifolius.*

There is a rather remarkable parallel between these two species and the European *C. piriformis* Brid. (*C. torfaceus* B. & S.) and *C. flexuosus* Brid. Here, too, the plants differ principally in size and robustness, in the presence of alar cells in the larger *C. flexuosus;* in both cases intermediate forms occur (R. Brown's *C. Bellii* is one of these in the New Zealand plants), scarcely differentiated except by the presence or absence of the alar cells. In the European plants, however, it is the more robust *C. flexuosus* which is the more abundant and highly variable species; in the New Zealand plants this is more characteristic of *C. torquatus.*

C. capillatus would seem to be rare. It occurs, however, in Tasmania and Australia; and its apparently limited range in New Zealand may be due to its having been confused with *C. appressifolius* and other species.

4. **Campylopus bicolor** (Hornsch.) Hook. f., Handb. N.Z. Fl., p. 415 (1867). [Plate VII, fig. 9.]

Syn. *Dicranum bicolor* Hornsch. in Sieber, M. Nov. Holl., *e* C. M., Syn. I, 392 (1849). *Campylopus Stewartii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 472, t. 37 (1896).

Var. ericeticola (C. M.) Dixon.

Syn. *C. ericeticola* C. M. in Abhandl. Nat. Ver. Bremen. 1900, p 496.

Leaves ending in a short, denticulate hyaline point.

Hab.—Chatham Islands, 1897 ; *leg.* Schauinsland. Mount Duval, N.S.W., Australia ; *leg.* Rev. W. W. Watts ; Nov., 1903.

Although *C. bicolor* is usually hairless, and is placed by C. Müller in the section Depiles (Brevifolii), its place is certainly taxonomically among the Trichophylli. The abrupt, subcucullate apex usual in the leaves reminds one strongly of that of *C. atrovirens* var. *muticus* Milde (var. *epilosus* Braithw.), where it is clearly a variation from type, not to say an abnormality. Moreover, in numerous specimens of *C. bicolor* which I have examined I have rarely found one without, here and there, especially in the comal leaves, some leaves bearing a distinct, shorter or longer hair-point.

Before seeing any normally piliferous form I had expressed the opinion to Rev. W. W. Watts, of Sydney, N.S.W., that *C. bicolor* was properly viewed as a hairless form of what should be, normally, a piliferous species. Shortly afterwards Mr. Watts sent me a plant as "*C. duvalianus* Watts n. sp.," which had been previously named *C. clavatus* R. Br. by Brotherus. The basal areolation is, however, quite different from that of *C. clavatus* (*cf.* my note in Journ. Linn. Soc. (Bot.), xl. 138), and I do not think there is any doubt that this plant is a piliferous form of *C. bicolor*, and in fact many of the leaves have the abrupt, muticous apex of the ordinary forms. I had proposed to call this piliferous form "var. *duvalianus*," but I find on examination of the type of C. Müller's *C. ericeticola* that it is certainly the same thing, and I have therefore retained the name for the variety. From a morphological point of view the piliferous plant should no doubt be considered the typical form, the muticous the varietal ; but the far greater prevalence of the latter, apart from priority of description, warrant its retention as the type.

R. Brown's var. *intermedia* (Trans. N.Z. Inst., *loc. cit.*) is scarcely worth maintaining, judging from the specimen in his herbarium.

The type form is widely distributed throughout Australia and Tasmania, but I do not know of any records for it in New Zealand outside the North Island. Hutton and Kirk collected it on Great Barrier Island.

5. **Campylopus Kirkii** Mitt. *apud* Beckett in Trans. N.Z. Inst., vol. 26, p. 280 (1893). [Plate VII, fig. 10.]

Syn. *Dicnemon Moorei* Broth. & Geh. in Rev. bryol., 1897, p. 67 (*nomen*). *C. bicolor* var. γ R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 472.

C. Kirkii is systematically nearly allied to *C. bicolor*, but is a quite well-marked species, and fairly easily recognized ; and is one of the most distinct of the genus. The leaves are less tapering, more obtuse and cucullate than in *C. bicolor*, very rarely if ever showing any trace of the hair-point ; the nerve is much narrower, less than half the width of leaf towards base, the alar cells form large conspicuous auricles, and the upper cells are extremely narrow with thickened walls. It is usually black in colour.

C. bicolor var. γ R. Br. ter., MS. in herb. (and Trans. N.Z. Inst., *op. cit.*, p. 472) belongs to *C. Kirkii*.

C. Kirkii has been found in Tasmania: in New Zealand I only know of three localities—Golden Bay, Nelson; Stewart Island; and Great Barrier Island. R. Brown's specimen has no locality attached, but it would appear to have been gathered, with *C. bicolor*, on Stewart Island.

B. Trichophylli.

6. Campylopus clavatus (R. Br.) H. f. & W., Fl. N.Z., ii, 69, *p.p.* (1855).

Syn. *Dicranum clavatum* R. Br. in Schwaegr. Suppl., iii, 2, t. 255 (1829–30). *Campylopus traillii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 468, t. 36 (1896). *C. cylindrothecium* R. Br. ter., *op. cit.*, p. 473, t. 38. *C. arcuatus* R. Br. ter., *op cit.*, p. 474, t. 38. *C. arenarius* R. Br. ter., *op. cit.*, p. 475, t. 38, *p.p.*

This and the two following species are very difficult to define and to distinguish from one another and from other species of the genus. As far as I am able to understand them they may be characterized in the following way: *C. appressifolius* is a taller plant with longer leaves, tending to produce long slender shoots with the leaves closely appressed; the perichaetia are aggregate in conspicuous, long-leaved comal tufts. The other two species are usually shorter, with shorter leaves, more densely ranked and often tending to produce stout, clavate branches; the comal tufts smaller. The basal areolation in *C. clavatus* and *C. insititius* I have described in Journ. Linn. Soc. (Bot.), xl, p. 438–42, at some length. *C. appressifolius* in this respect resembles *C. clavatus* very closely in structure, but has longer more gradually and more finely tapering leaves, and a somewhat narrower nerve.

C. clavatus appears to be a common species in Australia, but may be rare in New Zealand. All the plants in R. Brown's herbarium which I refer here were gathered in Stewart Island, except *C. cylindrothecium*. Of this there is no specimen so named; but a specimen of identical origin and date, "*C. scabriduli*, Bealey, coll. R. Brown, Feb., 1889," is, I have no doubt, the plant in question under another name, and belongs to *C. clavatus*.

7. Campylopus insititius H. f. & W., Fl. Tasm., ii, 172, t. 172 (1860).

Syn. *C. persimplex* C. M. in Abhandl. Nat. Ver. Bremen, 1900, p. 496.

I have endeavoured to bring out the characters of this species in the paper (Journ. Linn. Soc.) above referred to, as distinct from *C. clavatus*; but it is perhaps less easy to separate it from the piliferous form of *C. bicolor*, which it very closely resembles. That plant, however, has a wider nerve, a larger, more expanded leaf-base, which is distinctly narrowed at the insertion, broadest at some distance up, which is not the case with *C. insititius*, where it is, usually at least, broadest at or very near the base, and generally becomes rapidly involute.

I have examined the type of C. Müller's *C. persimplex*, and have no hesitation in placing it here. The plant referred by R. Brown ter. (Trans. N.Z. Inst., vol. 29) to *C. clavatus* is also, according to the specimen in his herbarium, *C. insititius*.

Until these plants have been carefully studied it is premature to attempt to indicate their distribution. I have seen several different gatherings of the present species, but all probably are from a somewhat limited area in the South Island. The original localities are, of course, in Tasmania.

8. **Campylopus appressifolius** Mitt. in Handb. N.Z. Fl., p. 414 (1867).

> Syn. *C. clavatus* H. f. & W., Fl. N.Z., ii, 69, *p.p.* (*nec Dicranum* xxxvi (1897), p. 352. *Campylopus sulphureo-flavus* Par., Ind. Suppl., p. 98 (1900). *C. strictissimus* C. M., MS. in herb., et Gen. Musc. Frond., p. 273 (*nomen*). *C. Walkeri* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 469, t. 36 (1896). *C. rarus* R. Br. ter., *op. cit.*, p. 470, t. 37. *C. ellipticothecum* R. Br. ter., *op. cit.*, p. 473, t. 38. *C. otaramaii* R. Br. ter., *op. cit.*, p. 474, t. 38.

I have seen the types of C. Müller's two species cited in the above synonymy. C. Müller was no doubt unacquainted with Mitten's *C. appressifolius* —it is not mentioned in the Gen. Musc. Frond.—or he would without fail have recognized it in his *C. strictissimus*, which is the typical form of it. *D. sulphureo-flavum* is a fertile plant with interrupted stems bearing comal tufts of leaves, and is less distinct in habit.

C. appressifolius is a frequent plant, and, as I have remarked above, is uncomfortably like some of the allied species in structure, and scarcely distinguishable at times except by the tall, slender habit and long appressed leaves of the sterile shoots. The hyaline points of the upper leaves will usually distinguish it from *C. capillatus*.

9. **Campylopus introflexus** (Hedw.) Mitt. in Journ. Linn. Soc., Bot., xii, p. 81 (1869).

> Syn. *Dicranum introflexum* Hedw., Sp. M., p. 147, t. 29 (1801). *Campylopus tasmanicus* Schimp., MS. in herb. *Dicranum tasmanicum* C. M. in Hedw., xxxvi (1897), p. 351. *D. leptocephalum* C. M. in Linn., xxviii (1856), p. 207 (*nomen*). *C. leptocephalus* Jaeg., Adumbr. ii, 435 (*fide* Mitten, M. Austr.-am., p. 84).

This very widely distributed and, in the Southern Hemisphere at least, almost cosmopolitan species scarcely needs description. It is especially characterized by the long, rigid, abruptly reflexed hair-points of the comal leaves, the dense clavate inflorescence, the deeply furrowed back of the nerve, and the basal areolation, of the same type as in *C. insititius* and *C. bicolor*, but usually with larger auricles than the latter and wider nerve than the former species. The hair-point, however, may be brownish and not hyaline, and is occasionally almost straight and not at all reflexed.

Dicranum tasmanicum (Schimp.) C. M. appears to belong here. It is not referred to by Rodway (Tasmanian Bryophyta (Mosses), 1914) ; it is cited by Paris (Ind., ed. ii) as "*C. introflexus* ? (*fid.* Broth.)" ; and that is the view I should take of Schimper's specimens at Kew. Weymouth, in Proc. R. Soc. Tasm., 1893, p. 205, states that Dr. Brotherus writes : "The large material I received from you has made me doubt whether this species differs at all from *C. introflexus*. . . In any case it is identical with *C. introflexus*, Fl. Tasm." The distinction suggested by C. Müller is that the leaves in *C. introflexus* are "multo latioribus," and the alar cells "distinctis majusculis" ; but the former character seems to me very doubtful, and the alar cells in *C. introflexus* are often quite inconspicuous. Moreover, he writes, "*C. introflexus* revera proximus et simillimus." It appears to me a slight form at the best.

9.* Campylopus pudicus (Hornsch.) Jaeg., Adumbr. i, 130 (1870–71).

Syn. *Dicranum pudicum* Hornsch. in Sieb. M. Nov. Holl., n. 24, *p.p.*

C. Müller (Syn., 1, 407) describes *D. pudicum*, distinguishing it from *D. introflexum* thus: "Statura alta gracillima interrupte innovante, foliis elamellosis et perigonialibus longe distat." The descriptions of the habit and of the perigonial leaves apply equally well, however, to *C. introflexus*; in fact, the description given by C. Müller of the perigonial leaves of the two species are in almost verbal agreement. There remains only the elamellose back of the nerve. I have not studied any original specimens, but I have examined plants from Australia which undoubtedly represent Hornschuch's species, and which differ from *C. introflexus* solely in the smooth back of the nerve. I conclude that *C. pudicus* is to be considered as a subspecies, at the best, of *C. introflexus*; the more so as forms of the latter occur with the nerve but slightly furrowed at back.

I refer to *C. pudicus*, a New Zealand plant received from Rev. D. Lillie, collected by J. Meiklejohn in 1908 near Invercargill, South Island. I have seen no other New Zealand specimens, but examination of the leaf-section in so-called *C. introflexus* would probably reveal its presence more or less frequently; it appears to be not uncommon in Australia and Tasmania.

Subgen. PALINOCRASPIS.

10. Campylopus arboricola Card. & Dixon sp. nov. [Plate VII, fig. 8.]

Sat robustus, olivaceo-viridis; caulis ad 3 cm. altus, rigidiusculus, rufotomentosus. Folia interrupte comosa, erecto-patentia vel leniter falcata, subconferta, 6–8 mm. longa, e basi concava late lanceolata cito in acumen subaequilongum canaliculatum *integrum laeve* angustata, superiora *in pilum longum capillaceum hyalinum infra plerumque terete, supra plusminusve dentatum* producta. Costa lata, *pertenuis*, circa $\frac{2}{5}$–$\frac{1}{2}$ folii latitudinem aequans, sectione duces plures, stereideas *ventrales et dorsales*, cellulas externas vix notatas exhibens. Rete folii basilare ubique rectangulare, viride, e cellulis juxtacostalibus latiusculis, inde paullo angustioribus, *marginem versus cito multo angustatis, tenerrimis, limbum latum conspicuum* instruentibus; alaribus *vix ullis*, nonnullis solum echlorophyllosis, parietibus pertenuibus, *maculam hyalinam* ad angulos formantibus; rete superius e cellulis ovato-rhomboideis, obliquis, supremis minutis instructum.

Fructus aggregati; theca siccitate plicata, cernua, leniter curvata, basi substrumulosa. Operculum et calyptra haud visa.

Hab.—Te Aroha, forming dense mats on tree-trunk; 1910; Leland and Chase: Herb. Cardot. Te Aroha Mountain, Auckland; Nov., 1896; *leg. et. comm.* D. Petrie.

This will easily be distinguished from the other species of the genus on examination of the nerve-section, but it is otherwise liable to be mistaken for one or more of the Trichophylli group. *C. clavatus*, however, has the alar cells large and coloured. *C. insititius* has the leaves less finely tapering, and a stouter, more toothed hair-point, while the hyaline border of cells occupies the whole width of the lamina at base, and passes obliquely outwards above. *C. appressifolius* may usually be known by the green points of the leaves, and the more conspicuous alar cells, but some forms may require examination of the nerve-section.

INCERTAE SEDIS.

11. **Campylopus nudus** (Hampe) Jaeg., Adumbr. i, 125 (1870-71). [Plate VII. fig. 11.]

Syn. *Dicranum nudum* Hampe in Linn., xxx (1859-60), p. 630.

C. Müller in the Gen. Musc. Fr., p. 263, under *Dicranum* (§ *Microcampylopus*), cites *D. nudum* Hampe from Australia, "die aber auch auf Neuseeland vorzukommen scheint." A specimen labelled "65. New Zealand" occurs in Hampe's herbarium, without collector's name. The position of the plant appears to me very uncertain; I have examined the type carefully without being able to arrive at any definite conclusion. The areolation and general structure and form of the leaves, especially in the upper part, agree closely with *Dicranodontium*, and the nerve-section appears to agree also; the base of the calyptra is naked. But the peristome is most distinctly not that of *Dicranodontium*; the sixteen teeth are distant, lingulate-lanceolate, flat and undivided for the greater part of their length, only divided for a short distance in the upper part; they are bright orange with deep red-brown trabeculae, faintly papillose below, distinctly vertically striolate above. The capsules are not estrumose as described by Hampe, but when in good condition show a slight but distinct struma. It appears, therefore, to belong either to *Campylopus* or *Dicranum*, and the curved seta would seem to place it here, perhaps, as C. Müller ranks it, with the subgenus *Microcampylopus*.

I do not know of any other station for it beyond the original (unknown) locality.

EXCLUDED SPECIES.

C. xanthophyllus Mont., Middle Island, Akaroa, Raoul; Dusky Bay, Lyall (*cf.* Fl. N.Z., ii, 68), is better dropped. The authors are very doubtful about the determination; there are no specimens in Hooker's herbarium. *C. xanthophyllus* Mont. (1845) is referable to *C. truncatus* C. M. (1844), and is a South American species.

THYSANOMITRIUM Schwaegr., Suppl. ii, Pt. i, p. 61 (1823).

Habit and foliation mostly of *Campylopus*; nerve-section as in *Dicranodontium* (*q.v.*); leaves (the comal especially) often hair-pointed. Seta cygneous, or erect and flexuose; capsule symmetrical, elliptic or elliptic-cylindrical, not plicate, usually tuberculate at base; calyptra longly fringed at base. Peristome-teeth inserted below the mouth, not united below, longly and narrowly subulate, entire or divided to base into two filiform halves, densely papillose.

Thysanomitrium leptodus (Mont.) Dixon comb. nov.

Syn. *Campylopus leptodus* Mont. in Ann. sc. nat., 1845, iv, 111.
Trichostomum leptodum Mitt. in Handb. N.Z. Fl., p. 116 (1867).
Pilopogon leptodus Broth. in Engl. and Prantl., Musci, p. 336.
Thysanomitriopsis Pilopogon C. M. in Hedw., xxxvi (1897), p. 363.

This plant, which as far as I know has been chiefly found in the North Island, principally near Auckland, has much the appearance of a tall, rather robust *Campylopus*. When in fruit the longly fringed calyptra, and the narrow, smooth, symmetrical capsule, will readily identify it. Sterile plants differ from all the New Zealand species of *Campylopus* except

C. arboricola in the nerve, having both ventral and dorsal stereid bands. From the latter it is known at once by the large inflated alar cells, as well as by the larger, longer leaves, which (except the comal, floral ones) do not end in the distinct white hair-point which is a marked character of that plant. The capsules are aggregated in dense heads, as in many species of *Campylopus*. It is found also in southern and equatorial South America. Cardot, probably following Paris, gives also the Auckland Islands, but I am inclined to think this is an error derived from the citation of "Auckland, Knight," in the Handbook. There are no Australasian specimens in the British Museum collection except those gathered by Colenso and Knight in New Zealand, nor are there any at Kew beyond the New Zealand plants, among which there is a single specimen from the South Island—viz., "Otago, Hector."

The nerve-section actually consists of a row of "Deuter" cells, with a fairly developed band of dorsal stereids, but on the ventral surface a single series of superficial cells almost equal to the "Deuter" cells, and only a very few stereids interposed between these two series, so that the general appearance is more like that of *Eucampylopus* than typical *Thysanomitrium*.

DICRANODONTIUM Bruch & Schimp., Bry. Eur., fasc. 41, 1847.

Stems slender, leaves setaceous from a wider, usually short base; nerve broad and flat with structure of *Campylopus* (*Palinocraspis*); basal areolation rectangular, usually with a more or less distinct border of extremely narrow cells; alar cells large, inflated. Capsule symmetrical, on a curved seta, calyptra usually naked at base; peristome-teeth cleft to base into two subequal subulate divisions, remotely articulate.

Distrib.—Europe; North America; with two or three species in the Southern Hemisphere (South Africa, New Guinea, Tasmania). A genus mostly of the north temperate regions. The two species referred to this genus in the "Handbook of the New Zealand Flora" do not properly belong here, but to *Campylopodium*.

Dicranodontium australe Dixon sp. nov. [Plate VII, fig. 6.]

Olivaceo-viride. Caulis flexuosus, 3–8 cm. altus, tenuis, vix radiculosus. Folia *fortiter regulariter circinata*, 6–7 mm. longa, e basi brevi convoluto-concava in subulam setaceam praelongam *subplanam superne argute remotiuscule, ad summam apicem dense argute dentatam, siccitate flexuoso-corrugatam* producta. Costa infra lata, circa $\frac{1}{3}$–$\frac{1}{6}$ partem folii latitudinis occupans, in subula angustior, medio subpellucida, apicem vix percurrens. Cellulae alares majores, tenerrimae, saepius hyalinae, fugaces, supra *lineares, parietibus firmis subincrassatis, haud porosis*, prope marginem seriebus pluribus angustissimis decoloratis, limbum plusminusve definitum instruentibus; ceterum supra sensim abbreviatae, parte inferiore subulae subquadratae, superne bistratosae subrotundae seu oblique ovales, saepe inanes, unde subulae margo subpellucida.

Fructus ignotus.

Hab.—Great Barrier Island, N.Z.; Hutton and Kirk. No. 63, Herb. Mitten, in herb. New York Bot. Gard.; South Fiord, Lake Te Anau; R. Brown ter.

This plant was found unnamed in Mitten's herbarium. It is sterile, but the leaf-structure shows it to belong with scarcely a doubt to *Dicrano-*

dontium, a genus hitherto unrepresented in New Zealand. It differs from most of the northern species, having circinate leaves with the supra-alar cells all linear, scarcely widened next the nerve, and the subula sharply and densely spinulose at the extreme apex, more remotely toothed below, scarcely channelled, obscure, but with the nerve showing as a pale median line, and a single marginal series of cells often subpellucid. Mitten's plant is only about 2 cm. high; Brown's specimen, on the other hand, is a fine plant, 8 cm. high, but otherwise agreeing.

D. tapes C. M. from Tasmania, the only other Australasian species of the genus, is a totally different plant

Campylopus nudus (Hampe) agrees very closely in leaf-structure, but is known at once by the non-circinate leaves and the inner supra-basal cells with strongly porose walls.

Mesotus Mitt. *apud* Hook. f., Handb. N.Z. Fl., p. 461 (1867).

Mesotus celatus Mitt., *op. et loc. cit.*

Syn. *Holomitrium undulatulum* C. M. in Hedw., xxxvi (1897), p. 365.

This very remarkable plant is not inaptly described by Mitten as having the leaf-structure of *Symblepharis*, creeping stem of *Macromitrium*, and teeth of *Grimmia*. It is an endemic species, and appears to be confined to the southern part of New Zealand. The only other species of the genus, *M. acutus* Mitt., belongs to Australia, the locality unknown. Paris (Ind. bryol.) gives also Tasmania, but the authority is very dubious. It is not included in either Bastow's or Rodway's works on Tasmanian mosses.

Dicnemon Schwaegr., Suppl. ii, Pt. 2, i, p. 72 (1826–27).

KEY TO THE SPECIES.

Leaves nerved to near apex	1. *calycinum.*
Leaves nerveless	2. *semicryptum.*

1. **Dicnemon calycinum** (Hook.) Schwaegr., *op. et loc. cit.* Handb. N.Z. Fl., p. 409. [Plate VII, fig. 4.]

Syn. *Leucodon calycinus* Hook., M. Exot., t. 17 (1818).

Hab.—Trees, frequent throughout the Island. It is recorded from Australia, but I am not clear on what authority (*cf.* Watts and Whitelegge, Census M. Australiens., Pt. i, p. 54). There are no Australian specimens at the British Museum, nor any at Kew with the exception of a scrap labelled " Nov. Holl.," but of exceedingly doubtful origin.

2. **Dicnemon semicryptum** C. M. in Hedw., xxxvi (1897), p. 364. [Plate VII, fig. 5.]

Syn. *D. Knightii* Hampe, MS. in herb., *et* C. M. Gen. Musc. Fr., p. 251 (*nomen*).

C. Müller describes the leaves of *D. calycinum* as much larger than those of *D. semicryptum*. This is no doubt frequently the case, but I do not find it to be at all a reliable character, nor can I find any vegetative characters to separate the two beyond the nerve—entirely wanting in *D. semicryptum*, long and strong in *D. calycinum*. The leaves in the latter may perhaps be rather more strongly convolute, but they vary much in this respect, as well as in outline, in both. The fruiting characters are, however, generally speaking, distinct. In *D. calycinum* the two or three upper bracts of the remarkable perichaetium taper gradually to rather long, though not fine, erect or suberect points, the uppermost much the longer (well shown in Hooker's figure, M. Exot., t. 17); the mature capsule is generally exserted from among these either terminally or laterally, so as to show the distinct struma at the base, and is slightly curved and distinctly asymmetrical. In *D. semicryptum* the upper bracts end abruptly in very short obtuse slightly divaricate subequal cusps, so that the perichaetium has the form of a vase with everted rim; the capsule is very nearly enclosed (apart from the lid)—whence the specific name—in the perichaetium: the base scarcely strumose, and the curvature slight (C. M. describes it as "recte cylindrica," but I find it slightly curved).

These characters are usually well marked and definite, and I have found it easy to pick out *D. semicryptum*—which in herbaria (*e.g.*, at Kew) is frequently mixed with *D. calycinum*—by this character, in conjunction with the usually smaller size of the former. But there is at Kew a very remarkable and perplexing plant issued by T. W. N. Beckett, "Otira Gorge, Westland, No. 997." This is a very robust plant, much more so than I have seen *D. semicryptum*, and has the nerved leaves of *D. calycinum*. There is therefore no doubt of its position. But the very numerous perichaetia are without exception precisely those of *D. semicryptum*, with the deoperculate capsule only just emerging with the orifice showing above the vase-like rim of the perichaetium; and in its form and total absence of struma agreeing quite well with *D. semicryptum*.

Moreover, Wilson, among his specimens of *D. calycinum*, has one "N. Zeald., 1848" (no locality or collector), of which he has given several drawings, showing in conjunction with the nerved leaves of *D. calycinum* the perichaetium and fruit precisely as in Beckett's plant above—*i.e.*, of *D. semicryptum*. In these two plants I have found no intermediate forms of perichaetium, and I venture the suggestion that the most satisfactory explanation of the problem is that the archegonia of the *D. calycinum* may have been fertilized, in these two plants, by antherozoids of *D. semicryptum*. If, however, as is stated to be the case, *D. calycinum* is autoicous (according to the "Flora of New Zealand" the male flowers are nidulant amongst the leaves of the fertile stem, their organic origin being uncertain, and their occurence quite irregular) this hybridization seems unlikely to have taken place so regularly, while in addition one would have expected to find, as usual in such cases, some trace of the female parent in the sporophyte. The whole problem would be an interesting one to study in the field.

Although, as I have said, the perichaetium in *D. calycinum* does not appear to show any marked variation so as to intergrade with *D. semicryptum*, there is a great deal of variability in the fruit itself, especially as regards its degree of exsertion; it may be strumose or not, and it may be almost totally immersed in the perichaetium (as in *D. semicryptum*) apart from the lid, or it may be so far exserted as to show the struma, and even a considerable part of the seta.

The original locality of *D. semicryptum* was "*prope* Greymouth, *leg.* R. Helms." Mr. James Murray collected it in the Waitakarei Hills, near Auckland, with *D. calycinum*. In R. Brown's herbarium it occurs in large robust tufts ex herb. T. W. N. Beckett under the name of "*Dicnemon calycinum*, on trees, Arthur's Pass, N. Canterbury." Other specimens exist in the herbaria at Kew and the British Museum.

D. Knightii Hampe in Hampe's herbarium appears to me to be quite inseparable from *D. semicryptum* C. M.

Dicnemon Moorei Broth. & Geh. = *Campylopus Kirkii* Mitt.

Dicnemon obsoletinerve Hampe & C. M. = *Dicranoloma fasciatum* (Hedw.) Par.

EUCAMPTODON Mont. in Ann. sc. nat., 1845, p. 120.

Plants of varying habit, often robust. Leaves similar to *Dicnemon*, often shortly hair-pointed. Capsule upright and symmetrical, rarely slightly curved. Peristome-teeth broadly lanceolate, obtuse, entire or shortly divided at apex only.

Differs from *Dicnemon* principally in the erect symmetrical capsule and the almost undivided or quite entire peristome-teeth.

Eucamptodon inflatus (H. f. & W.) Mitt. in Trans. N.Z. Inst., vol. 25, p. 300 (1892).

Syn. *Hypnum inflatum* H. f. & W., Fl. N.Z., ii. 111, t. 90 (1855); Handb. N.Z. Fl., p. 481. *Coelidium inflatum* Jaeg., Adumbr. ii, 384. *Lembophyllum inflatum* Par., Ind., p. 718.

It is on scarcely more than conjectural grounds that this striking plant is placed in the genus *Eucamptodon*, not having been found in fruit. Mitten wrote on its position (Trans. N.Z. Inst., vol. 25, p. 300), "I keep it as a species of *Eucamptodon*, which is almost the same as *Dicnemon*, but *Eucamptodon* has an erect capsule; in the other genera it is curved and unequal." In the absence of fruit I should have been inclined rather to place it in *Dicnemon*, in view of the Polynesian (? Australian, *cf.* Salmon in Journ. Bot., 1901, p. 5) *D. rugosum* (Hook.), which is by no means unlike the New Zealand plant in appearance.

It is a tall, robust, handsome moss with large, inflated, very rugose leaves, ending in a short fine apiculus, and nerveless. It is perhaps most like *Braunfelsia obesifolia*, but that has much more rigid, not rugose, and not apiculate leaves, with a single nerve.

It has been found in both North and South Islands, but is no doubt rare.

Eucamptodon Petriei Broth. = *Braunfelsia obesifolia* (R. Br. ter.) Dixon.

LEUCOBRYACEAE.

LEUCOBRYUM Hampe in Linn., xiii, 42 (1839).

The number of species credited to New Zealand by Paris (Ind., ed. ii) is three; by C. Müller, in the Gen. Musc. Fr., six. I have very little hesitation, however, in reducing them all to the single type, *L. candidum* (Brid.) Hampe, with perhaps two fairly well-marked varieties. In all the fertile plants I have seen the fruit presents no variation whatever, the length of the seta alone showing some variability, and this not correlated with any other characters, not even with the general degree of robustness of the plants. The vegetative characters are far more variable, but the internal leaf-structure is remarkably uniform throughout, and the valuable work of Cardot on the Leucobryaceae has emphasized the importance of this in the taxonomy of the order.

The structure of the leaf in the more robust forms of the New Zealand plants is that which Cardot terms "heterostrosic"—that is to say, that while the leaf-section in the middle and upper parts of the leaf shows a single ventral and a single dorsal layer of hyaline cells (*hyalocysts*), with the *chlorocysts* median, the basal section shows several layers (2–3) of hyalocysts on both the ventral and dorsal sides of the chlorocysts, corresponding to a considerable thickening of the leaf. This thickening, however, does not extend across the whole width of the nerve, as along the median line the hyalocysts continue to be in two layers only, one ventral and one dorsal layer, so as to form a neck, so to speak, or isthmus, which may be of varying length: sometimes only a single cell on the median line of the leaf being involved, while in other cases 3–5 series of cells on either side of the median line are undivided, the narrow neck then occupying a considerable proportion of the width of the leaf-section. In this case the section is practically identical with that figured by Cardot for *L. aduncum* Doz. & Molk. (Card., "Recherches Anatomiques sur les Leucobryées," pl. iv. fig. 14, *a*). In the smaller forms, notably those which usually pass as *L. brachyphyllum* Hampe, the thickening of the ventral and dorsal layers of hyalocysts at the leaf-base is very much reduced, and may even be confined to a few cells on each side of the median line. This is the state figured by Cardot (*op. cit.*, pl. vi. fig. 24, *a, b, c*). I have, however, not met with this extreme state myself; most of the leaves of the smaller forms from Australia and New Zealand showing 2–3 layers of hyalocysts on the dorsal face at least, over a considerable part at least of the section near the base, usually with a very short isthmus or neck; while I have observed every stage of gradation, both as to the multiplying of the hyalocyst layers and the length of the "isthmus," up to the most extreme form as in *L. aduncum* cited above. This degree of development is usually parallel to the greater or less size of the leaf; and where, as frequently occurs, two forms of leaf are found on the same plant, the smaller leaves will sometimes show the simpler, the larger the more highly developed structure. The chlorocysts are centric above, usually centric or slightly hypercentric towards base.

One of the most striking forms is that named by C. Müller *L. speirostichum*, and referred to under that name by Geheeb in Rev. bryol., 1876, p. 3, and also by C. Müller in the Gen. Musc. Fr., but in each case unaccompanied by any description. It has the leaves strikingly seriate in 5 rows, and usually more or less falcate at the tips. I fail, however, to find any other character, structural or otherwise, to separate it from *L. candidum*, the fruiting characters showing no differences. Geheeb (*loc. cit.*) writes of *L. speirostichum*, "Selon M. Hampe c'est le *L. Teysmannianum*." Of the two Javan species with seriate leaves, however, it is not *L. Teysmannianum* so much as *L. pentastichum* Doz. & Molk., with which it should be compared; since *L. Teysmannianum*, so far as it differs from *L. pentastichum*, does so in the failure of the hyaline leaf-border to reach the apex, while in *L. pentastichum* this border is continued, in 2–3 rows of cells at least, to the tip, as is the case with *L. candidum*. I am, in fact, unable to separate *L. speirostichum* C. M. in any way from *L. pentastichum*. The anatomy and general structure of the leaves of the Australasian and Javan plants is identical (the fruit of *L. pentastichum* has not been found).

In this connection a note of Fleischer's is interesting. Under *L. pentastichum* (Musci . . . von Buitenzorg, i. 148) he writes: "*L. strictifolium* Broth. in sched., aus New-Sud-Wales, scheint eine kurz und geradblättrige Abart unserer Art zu sein." Now, I am convinced, from the specimen which I have of *L. strictifolium* Broth. through the kindness of Dr. G. Roth, that that plant is simply a straight-leaved form of *L. speirostichum* (or, as I prefer to call it, *L. candidum* var. *pentastichum*). I have in my herbarium New Zealand plants of the "*speirostichum*" form, showing in the same gathering falcate leaves and also straight-leaved stems, identical with *L. strictifolium* Broth. The only distinguishing characters mentioned by Brotherus (in Oefv. af Finska Vet. Soc. Foerh., lv, 159) from *L. brachyphyllum* (*i.e.*, *L. candidum*) are "fol. pentastiche dispositis, strictis, latius limbatis." In the diagnosis the hyaline border is described as "a seriebus cellularum 5–6 formato"; but in forms of *L. candidum* it is quite usual to find the border as wide as that even in the upper part of the leaf.

I have, to sum up, no hesitation in concluding that *L. pentastichum* is identical with *L. speirostichum*; and I think it highly probable that *L. pentastichum* is a seriate form of *L. aduncum* Doz. & Molk., and that that species will have to be reduced to *L. candidum* (Brid.). On the last point, however, I do not feel well qualified to judge; and, as there is some difference of general habit and appearance between the Javan *L. aduncum* and the various forms of the Australasian plant, I have left the question to be decided by others with a better knowledge of the Javan plants.*

The New Zealand species will then stand as follows:—

Leucobryum candidum (Brid.) H. f. & W., Fl. N.Z., 2, 64 (1855); Handb. N.Z. Fl., p. 409.

Syn. *Dicranum candidum* Brid., Bryol. univ., i, 409 (1826). *Dicranum brachyphyllum* Hornsch. in Sieber M. Nov. Holl. (*nomen*). *Leucobryum brachyphyllum* Hampe *apud* C. M. in Linn., xvii, 317 (1843), *nomen*, et in Linn., xviii, 688 (1844). *L. spinidorsum* C. M. in Hedw., xxxvi (1897), p. 331. *L. interruptum* C. M., MS. in Herb., et Gen. Musc. Fr., p. 81 (*nomen*). *L. brachypus* C. M., MS. in Herb., et Gen. Musc. Fr., p. 81 (*nomen*).

Var. **majus** Jaeg., Adumbr. i, p. 159 (1871–72).

Syn. *L. laticaule* C. M. in Hedw., xxxvi (1897), p. 331.

Var. **pentastichum** (Doz. & Molk.) Dixon comb. nov.

Syn. *L. pentastichum* Doz. & Molk., Bry. jav., i, 16, t. xv. *L. speirostichum* C. M., MS. in Herb., et Gen. Musc. Fr., p. 80 (*nomen*). *L. strictifolium* Broth. in Oefv. af Finska Vet. Soc. Foerh., lv (1898), p. 159.

L. candidum is widely distributed throughout the Islands, most frequently sterile. The var. *majus*, a robust plant with long simple branches, and large, long, narrowly pointed leaves, is also widely distributed, and passes by insensible degrees into the type. The var. *pentastichum* has a similar distribution, and is a very distinct plant in its best-marked condition, but the seriate position of the leaves is at times poorly marked, and it is sometimes not easy to separate the type and variety.

The smaller, short-leaved forms of *L. candidum*, which it might be reasonable perhaps to separate off as a variety in the opposite direction to the var. *majus*, are sometimes extremely small: the leaves in these forms tend to have the apex rough at the back in a greater degree than the taller, longer-leaved ones.

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* Since the above was in type I learn that a paper has appeared by Thériot, which I have not seen, in *Bulletin de la Société de Genève*, vol. xii (1921), on "Le problème du *Leucobryum candidum*," which should be consulted.

I have examined the types of C. Müller's new species given in the synonymy above; they all appear to me inseparable from one or other of the forms of *L. candidum*. *L. interruptum* C. M. (Neu Seeland, *leg.* Helms, 1886) is only a form with the leaves more than usually rugose at back above; I have numerous similar and intergrading forms from New Zealand. *L. spinidorsum* C. M. (Tasmania, *leg.* Weymouth, 1889) is a form with broad, short leaves, highly rugose at back, but scarcely more so than in forms in my herbarium with normally shaped leaves, and quite typical in leaf-section.

FISSIDENTACEAE.

FISSIDENS Hedw., Fund. ii, p. 91 (1782).

According to Brotherus's arrangement, following closely on C. Müller's, this large genus of more than 600 species falls into four subgenera, one (*Pachyfissidens*) being unrepresented in the Island; of the others, *Eufissidens*, containing the bulk of the species, is divided into 12 sections. As these divisions are for the most part not only natural ones but at the same time of considerable practical value in the determination of species, I give here a brief summary of the characters of those groups represented in New Zealand.

Subgen. I. POLYPODIOPSIS C. M. Small terrestrial mosses. Stem-tissue lax, without central strand. Leaves flaccid, narrowly bordered. Nerve failing; leaf-cells lax. Seta terminal. Calyptra conical, usually entire at base.

F. dealbatus H. f. & W.

Subgen. II. EUFISSIDENS Mitt.—Plants of varying size. Stem with central strand. Nerve present; border present or absent. Cells mostly small, more or less isodiametrical, rarely larger and prosenchymatous. Seta mostly terminal. Calyptra usually cucullate, rarely entire.

§ *Bryoidium* C. M.—Small, mostly bright green terrestrial, rarely rupestral mosses. Leaves bordered throughout, border not thickened, often faint above. Cells small, hexagonal, thin-walled, more or less pellucid, rarely obscure. Seta nearly always terminal. Branches of peristome-teeth spirally thickened.

F. inclinabilis C. M.
F. campyloneurus C. M. & Beck.
F. obscurifolius Dixon.
* *F. gonioneurus* C. M.

§ *Pachylomidium* C. M.—Plants more robust, usually calcicolous water-plants. Leaves bordered throughout; border stout, thickened. Cells, seta, &c., as in *Bryoidium*.

F. rigidulus H. f. & W.

§ *Heterocaulon* C. M.—Very small terrestrial plants. Stems dimorphous; sterile stems with minute leaves, having the dorsal lamina almost or quite undeveloped; fertile stems shorter, with larger leaves, dorsal lamina developed, but ceasing far above the base of the leaf. Border only on the vaginant lamina. Cells, &c., as in *Bryoidium*.

F. Taylori C. M.

§ *Semilimbidium* C. M.—Very small, mostly dull green, terrestrial plants. Leaves bordered only on the vaginant lamina, or very faintly elsewhere: margins of the superior and dorsal lamina usually crenulate-denticulate. Cells small, usually finely papillose and opaque. Seta and peristome as in *Bryoidium*.

F. vittatus H. f. & W.
F. anisophyllus Dixon.
F. abbreviatus Mitt.

§ *Aloma* C. M.—Small terrestrial mosses. Leaves thin, unbordered, more or less crenulate at margin. Cells hexagonal, pellucid. Seta and peristome as in *Bryoidium*.

F. tenellus H. f. & W.
F. aeruginosus H. f. & W.

§ *Amblyothallia* C. M. Plants of middle size, with mostly elongate stems. Leaves firm, longly and narrowly lingulate, obtuse or subacute, decurved-falcate or enrolled when dry, unbordered, almost entire. Cells small, obscure or pellucid. Seta terminal. Branches of peristome-teeth papillose, rarely obscurely nodose.

F. pallidus H. f. & W.
F. oblongifolius H. f. & W.
F. asplenioides Sw.

§ *Serridium* C. M. Middle-sized to very robust plants: stem elongate. Leaves large, not bordered, often with a paler margin of more pellucid cells, usually broadly pointed, mostly denticulate or serrate above. Seta usually lateral. Branches of peristome-teeth nodosely thickened.

F. adiantoides (L.) Hedw.

Subgen. OCTODICERAS (Brid.) Mitt.—Weak, soft, floating plants; stem without central strand; seta short, lateral, or from a short lateral branch, minute, symmetrical, oval; calyptra conical, usually entire at base.

F. Mülleri (Hampe) Mitt.

The above characters will sufficiently characterize the two species *F. dealbatus* and *F. Mülleri*, and I have not included them in the following key.

The distinctions between the sections *Bryoidium* and *Semilimbidium* are not always well defined, and plants with a *faint* border to the upper part of the leaf should be tried in both divisions of § 3 of the key.

KEY TO THE SPECIES OF EUFISSIDENS.

1.	Dorsal lamina very narrow, confined to upper part of leaf, or wanting	6. *Taylori.*
	Dorsal lamina normal	2
2.	Leaves with a hyaline border, at least on vaginant lamina	3
	Leaves without a hyaline border	10
3.	Leaf distinctly bordered throughout	4
	Vaginant lamina alone bordered, a faint border sometimes elsewhere (*inclinabilis*, *anisophyllus*, and *leptocladus* may be sought here)	8
4.	Plants robust with elongate stems; border stout	5. *rigidulus.*
	Plants small; border narrower	5
5.	Cells very small, isodiametrical, very obscure	6
	Cells larger, irregularly hexagonal, more pellucid, lax and elongate in vaginant lamina	7
6.	Stem short, leaves in few pairs, nerve and border scarcely reaching apex	4. *leptocladus.*
	Stem elongate, leaves multijugous, rigid, erect; stout nerve and border very pellucid, reaching apex and confluent in point	4.* *gonioneurus.*

7. Border very narrow and indistinct in superior and dorsal laminae, not reaching apex .. .. 3. *inclinabilis.*
Border well marked, nearly always reaching apex and confluent with the nerve in point .. .. 2. *campyloneurus.*

8. Cells very obscure 9
Cells pellucid, leaves frequently bordered narrowly throughout 8. *anisophyllus.*

9. Leaves narrow, complanate .. .. 9. *abbreviatus.*
Leaves crispate when dry, very wide at base, not complanate 7. *vittatus.*

10. Plants minute, leaves very small, about 1 mm. long 11
Plants taller, leaves rarely less than 3 mm. long 13

11. Margin of vaginant lamina distinctly crenulate-denticulate 12
Margin of vaginant lamina entire, plant pale .. .. .. 12. *pallidus.*

12. Leaves oblong, acute, not longly tapering .. .. .. 10. *tenellus.*
Leaves very narrow, acuminate, gradually tapering to a very acute point 11. *aeruginosus.*

13. Robust; leaves broad, more or less pale-bordered, sharply toothed above 15. *adiantoides.*
Much smaller, leaves narrow, entire or nearly so 14

14. Leaves crisped and enrolled when dry, cells opaque .. 14. *asplenioides.*
Leaves unaltered, or falcate only when dry, cells chlorophyllose 13. *oblongifolius.*

Subgen. POLYPODIOPSIS C. M.

1. **Fissidens dealbatus** H. f. & W., Fl. N.Z., ii, 63, t. 84; Handb. N.Z. Fl., p. 407.

Very distinct in its nerveless, thin, pellucid leaves with Bryoid areolation. I suppose it to be an uncommon species. I have it from both North and South Islands.

Subgen. EUFISSIDENS Mitt.

§ *Bryoidium* C. M.

2. **Fissidens campyloneurus** C. M. & Beck. in Trans. N.Z. Inst., vol. 25, p. 295, t. 44 (1892). [Plate VII, fig. 3.]

This and the following differ from the remaining species of the section in the areolation, which is angular, more or less hexagonal or hexagono-rhomboid, thin-walled, and rather pellucid, the basal cells, especially of the vaginant lamina, being very lax, elongate, and hexagonal-rectangular. *F. campyloneurus* has the leaves long and narrow, with a very acute acumen, the tip often a cuspidate point formed by the confluent nerve and border. The border and nerve may, however, as pointed out by Beckett, sometimes vanish below the apex in the upper leaves. The bending of the nerve where it leaves the vaginant lamina (from which the specific name) is usually a marked character, but may be indistinct, especially in leaves of sterile stems. The inflorescence may perhaps be truly dioicous; I have not seen male plants, nor were they found by Beckett. The capsule may be erect or more or less inclined; capsules gathered before maturity generally become strongly arcuate.

It appears to be a frequent species in New Zealand, and probably occurs in Tasmania and Australia.

3. **Fissidens inclinabilis** C. M., MS. in Herb., et Gen. Musc. Fr., p. 59 (*nomen*), sp. nov. [Plate VII, fig. 2.]

Rhizautoicus. Habitu, forma foliorum et areolatione *F. campyloneuri*, laminis autem superioribus dorsalibusque *tenerrime* limbatis, *saepius omnino* *fere elimbatis*, apice folii igitur *nervo tantum excurrente* breviter apiculato. Seta pallida, flexuosa, *longa*, 1 cm. vel supra. Theca inclinata; operculum acute rostellatum.

Hab.—New Zealand; Beckett, 1892; auf dampfender Erde bei Christchurch; Herb. C. Müller. I have in my herbarium a specimen sent to Rev. C. H. Binstead by T. W. N. Beckett, as "*F. campyloneurus*: on damp clay, Fendalton, near Christchurch, N.Z., Aug., 1896," which is certainly *F. inclinabilis*, and not improbably from the same locality as the type. North-east Valley, Dunedin; *leg. et comm.* D. Petrie.

The border is so faint everywhere except on the vaginant lamina, where it is stout, that I should have been almost inclined to place the species under *Semilimbidium*. Its very close relation to the last species, however, seems to demand its retention in the present section, where C. Müller places it. It is indeed doubtful whether it be more than a varietal form of *F. campyloneurus*, of which it appears to have the fruiting characters.

F. anisophyllus and *F. vittatus* differ in the broader leaves with less acute points, the areolation of a different type, with firmer thicker walls, smaller, and not elongate in the vaginant lamina, which also in *F. vittatus* is quite differently bordered.

I am quite unable to separate from *F. inclinabilis*, a plant sent me from Mitten's herbarium, "Brisbane, Queensland, Bailey; 256, *p.p.*," without name.

4. **Fissidens leptocladus** C. M. *e* Rodway, Tasmanian Bryophyta, Mosses, p. 74 (1914). [Plate VII, fig. 1.]

Dioicus. *Validiusculus*; olivaceo-viridis, densiuscule caespitosus, caulis 5–7 *mm. altus*, simplex; folia *plurijuga*, subfalcata decurvata, sicca *valde crispato-falcata*, ad 2 mm. longa, oblongo-lanceolata, apice angustato, plus-minus acuto; lamina vaginans circa dimidiam folii longitudinem aequans, vel ultra, lamina dorsalis infra angustata, *folii basin attingens*; costa *valida, pellucida, flexuosa*, senectute purpurascens, subpercurrens; limbus *ubique bene notatus*, supra *tener*, hyalinus, apicem versus saepe valde attenuatus. Areolatio *perobscura*, e cellulis *minutis* (5–6 μ), *opacis*, parietibus pro more incrassatis, ad basin minime mutatis, instructa. Seta breviuscula, crassiuscula, flexuosa; theca suberecta, sicca *urceolata*, operculo conico-rostellato.

Hab.—Kaitangata, Otago; September, 1892; *leg.* D. Petrie. Bank of creek, Mauriceville, Wairarapa; *leg.* W. Gray (No. 192c). Waitakarei Hills, Auckland; December, 1907; *leg.* Jas. Murray (No. 52).

I had described and figured this species—and it was already in type—as *F. obscurifolius* sp. nov. I have since recognized its identity with the Tasmanian plant named *F. leptocladus* by C. Müller in herb. Weymouth, and described by Rodway, *op. cit.* As it is a little known plant I have allowed the description to stand.

Var. Cheesemanii (C. M.) Dixon var. nov.

Syn. *F. Cheesemani* Geh., MS. in herb. C. Müller, et C. M., Gen. Musc. Fr., p. 59 (*nomen*). *F. lineari-limbatus* C. M., MS. in herb. *et op. et loc. cit.* (*nomen*) (*nec F. lineari-limbatus* C. M. in Fl., 1890, p. 471).

Minor; folia *angustiora*, lamina dorsali infra *peranqusta*, folii basin *vix vel haud attingens*.

Hab.—New Zealand; *leg.* Cheeseman; 1882. New Zealand; *leg.* Reader; 1882. Both in herb. C. Müller.

This species appears to have been overlooked ; it can hardly be rare. It occurs in the Kew collection as "*F. Knightii*," Reichdt., det. Mitten, 2/86, N.Z., Reader. 34, 1880" (*F. Knightii* belongs to the § *Amblyothallia*, and cannot be this). It is quite distinct in the very small and very obscure areolation and leaves falcato-crisped when dry from all the bordered species except the following.

F. Cheesemanii in C. Müller's herbarium is a poor, undeveloped sterile form of this. *F. lineari-limbatus* is in fruit and better developed, and may, with the former, be considered a varietal form with narrower leaves and dorsal lamina scarcely reaching to base, often ceasing far above.

4.* **Fissidens gonioneurus** C. M., MS. in herb., et Gen. Musc. Fr., p. 59 (*nomen*) subsp. nov.

F. leptoclado affinis : *elatior*, ad. 1·5 cm. altus : folia multijuga, conferta, *stricta, erecta, nec patentia nec flexuosa*, breviora, e medio vel infra *sensim attenuata*, acutiora : costa *pervalida*, perpellucida, apud laminae vaginantis apicem *flexuoso-angulata*, supra flexuosa. Cetera ut in *F. leptoclado*. Fructus ignotus.

Hab.—New Zealand ; *leg.* Helms ; 1885 (herb. C. M.).

The specimen sent to me was between mica, and it was not easy to determine the position of the leaves when dry, but I believe them to be scarcely altered : this would give a very marked distinction from *F. leptocladus*. In any case, however, the tall habit, very straight, rigid leaves, much stouter nerve, &c., appear to be good characters, as is the bending of the nerve as it leaves the vaginant lamina, although this is a feature shared by several other species (*e.g.*, *F. oblongifolius*, *F. campyloneurus*). It has the aspect, to some extent, of a very delicate, narrowly bordered *F. rigidulus*. More recently, however, I have seen specimens which indicate that the characters given above are some of them inconstant, and that the plant is unworthy of higher than subspecific rank at the highest (*cf.* notes on excluded species at the end).

§ *Pachylomidium* C. M.

5. **Fissidens rigidulus** H. f. & W., Fl. N.Z., ii, 61, t. 83 (1855) ; Handb. N.Z. Fl. p. 407.

Syn. *F. Lechleri* Hampe in Bot. Zeit., 1864, p. 340.

Distrib.—Tropical South America ; Chile ; Australia ; Tasmania ; New Zealand.

One of the most distinct species in the tall branched stems, forming elongate but rather narrow fronds, the subaquatic habit, and stoutly bordered leaves with very obscure opaque areolation. The leaves are incurved-falcate when dry, with spirally twisted points. The fruit seems to be comparatively uncommon.

§ *Heterocaulon* C. M.

6. **Fissidens Taylori** C. M., Syn., 1, 65 (1848).

Syn. *F. brevifolius* H. f. & W., Fl. N.Z., ii, 61, t. 83 (1855) ; Handb. N.Z. Fl. p. 408. *F. pygmaeus* Tayl. in Lond. Journ. Bot., v. (1846), p. 66 (*nec F. pygmaeus* Hornsch.). *F. ramiger* C. M. & Beck. in Trans. N.Z. Inst., vol. 25, p. 294, t. 43 (1892).

There is no specimen of the New Zealand *F. brevifolius* in Hooker's herbarium (it appears to have been found in very small quantity, and

Hooker has annotated the Kew copy of the Fl. N.Z. "drawings only"); the South African and South American plants referred to it in the Handbook were later separated off by Mitten (*cf.* M. Austr.-am., p. 596). The New Zealand plant exists in Herb. Wils. at the British Museum, in the form of three stems labelled "N.Zd., 1850, Colenso." They show, as do Wilson's drawings, the "heterocaulon" character very distinctly, the leaves being almost entirely composed of the vaginant lamina, the superior laminae forming a short point in the leaves of the sterile stems, while in those of the short fertile stems they form a very narrow almost subulate rigid cuspidate point, approximately equal in length to but far narrower than the vaginant lamina, the dorsal lamina being almost or entirely suppressed.

I have examined the type of *F. pygmaeus* Tayl. (Swan R., Jas. Drummond, 1843) at Kew, and there can be no doubt that it and *F. brevifolius* H. f. & W. are the same thing. *F. pygmaeus* Tayl. is antedated by *F. pygmaeus* Hornsch., and the name was altered to *F. Taylori* by C. Müller in the Synopsis; this must therefore have priority over *F. brevifolius* H. f. & W.

Specimens in Herb. Hook. at Kew labelled *F. brevifolius*, from Victoria, Australia, collected by Müller do not belong here at all, but to a species of *Semilimbidium*. And the two specimens "Tasmania, Archer," determined as *F. Taylori* by Mitten equally belong to another section altogether, not *Heterocaulon*.

F. ramiger C. M. & Beck. also is identical with *F. Taylori*; in fact, the plate of that species in the Transactions might very well have been made from Wilson's drawings of *F. brevifolius*!

Colenso's plant would probably be collected in the North Island. *F. ramiger* is recorded from Lyttelton Hills, on clay; Malvern Hills, on sod-banks.

Semilimbidium C. M.

7. Fissidens vittatus H. f. & W., Fl. Tasm., ii, 167, t. 171 (1860).

Distrib.—New Zealand (*teste* Brotherus, Musci, p. 356); Tasmania; Australia. I have seen no New Zealand specimens, and do not know the authority for the record.

F. vittatus is distinguished by the broad, somewhat undulate falcate leaves, not at all complanate, the vaginant lamina ventricose and not closely conduplicate; the cells small, extremely dense and opaque; the nerve very pellucid; the border very narrow, often wanting, in the superior laminae, variable on the vaginant lamina, but usually stout and marginal in the upper part, narrower and intramarginal towards base. (The figure 216 of Brotherus—Engler & Prantl., Musci, p. 357—shows the areolation much too lax and pellucid, and the border too regularly intramarginal, besides giving the impression that the border and nerve are darker than the lamina, instead of, as they actually are, very pellucid). The dorsal lamina is extremely narrow towards the base of the leaf, and more pellucid. The capsule is more or less inclined and asymmetrical.

The only species with which this could well be confused are *F. anisophyllus* (*q.v.*) and *F. leptocladus*, which is very similar in the dry state, but when moist has the leaves complanate, not falcate; they have not the wide, ventricose vaginant lamina, the areolation is a little less dense and opaque, the border in the upper part stronger, and on the vaginant lamina not intramarginal.

8. **Fissidens anisophyllus** Dixon in Journ. Linn. Soc. (Bot.), xl, 442, t. 21.

The student may be referred to the above publication for this species. Later specimens collected by Mr. Gray on Mount Bruce, Wairarapa, show the plant slightly larger and better developed with the leaves rather more strongly falcate when dry. The very faint border, often almost entirely wanting, and rarely well developed except on the vaginant lamina, will distinguish it from all but *F. vittatus* and *F. leptocladus;* from these it differs at once in the usually smaller size, the very unequal leaves of the fertile stem, the upper leaves of quite different form and tissue, the cells being chlorophyllose, more or less pellucid, and distinct. *F. inclinabilis* differs in the areolation, especially at base, and the leaves apiculate with the excurrent nerve.

The Mount Bruce specimens, which I refer with some slight uncertainty to this species, have wider, shorter leaves, but in areolation closely resemble *F. anisophyllus*, and have in no way the dark opaque cells of *F. vittatus*.

It is a very moot point whether *F. anisophyllus* should not be placed in the § Bryoidium.

9. **Fissidens abbreviatus** Mitt. in Seemann, Fl. Vit., p. 385 (1873).

A very minute species of the § Semilimbidium, having the leaves without any trace of hyaline border except on the vaginant lamina, and there usually absent except on the upper or floral leaves of the fruiting-stems, where, however, though very narrow, it is quite well defined. The upper cells are extremely small, 5–7 μ wide, obscure, distinctly but very minutely pluripapillose; the leaf-margin very finely but usually quite distinctly crenulate. The leaves are narrow, shortly tapering to a not very acute apex, which may, indeed, be obtuse or subobtuse. The narrow, rather pellucid nerve generally ceases quite appreciably below though very near to the apex. The capsule is minute, suberect on a short, slender seta. The dorsal lamina of the leaf is narrowed below, but usually reaches the base of the leaf.

No specimens of the type appear in the national collections in London, nor, as Mrs. Britton informs me, are there any under that name in Mitten's herbarium. Mrs. Britton, however, has sent me a portion of a plant "*F. parvulus* Mitt. MS. in herb.; Raoul I., Kermadecs; MacGillivray, 1854." This contains two species, one which from Mitten's drawings is clearly his *F. parvulus*, but which cannot be separated from *F. tenellus* H. f. & W.; the other a species of Semilimbidium, which agrees exactly with Mitten's description of *F. abbreviatus*, and is, indeed, without any doubt part of the original gathering of that species, which was collected on Raoul Island by MacGillivray in 1854 (*cf.* Fl. Vit., *loc. cit.*).

It is quite distinct from the other New Zealand species in the small size, narrow leaves, almost entirely unbordered, and with very minute, obscure but not very opaque cells.

§ *Aloma* C. M.

10. **Fissidens tenellus** H. f. & W., Fl. N.Z., ii, 61, t. 83 (1855).

Syn. *F. leptochaete* C. M., MS. in herb., et Gen. Musc. Fr., p. 62 (*nomen*),
nec F. leptochaete Dus. in Arkiv för Bot., Bd. vi, No. 8, p. 5 (1906).

This species is known immediately from all the New Zealand species but the next by the small size, delicate pellucid leaves without any border, and with the margin regularly and prettily crenulate throughout, especially on the vaginant lamina ; in the upper leaves of the fertile stems the crenulations on this part sometimes become almost spinulose.

It seems to be distributed throughout the Islands, and is found in Tasmania and Australia.

The type of *F. leptochaete* C. M. (Neu Seeland, Beckett, 1892) differs in no way from *F. tenellus*.

I follow Brotherus in placing this species in § *Aloma*, but am doubtful whether it is not more properly a *Crenularia*. It is, at any rate, extremely close to *F. papillosus* Lac. and *F. punctulatus* Lac., which belong to that section. The cells bear each a rather high single papilla on the lumen.

11. **Fissidens aeruginosus** H. f. & W., Fl. N.Z., ii, 62, t. 83 (1855) ; Handb. N.Z. Fl., p. 408.

A very obscure species. There are no specimens in either Hooker's or Wilson's herbarium. Wilson's careful drawings of "H. 3750, N.Z., Colenso," seem to bear out the distinction given in the Fl. N.Z., that *F. aeruginosus* differs from *F. tenellus* in the wider, shorter, more flabellate frond, the leaves somewhat more rigid, and gradually and longly tapering to a very narrow point.

I have received a specimen from the New York Botanical Garden ex herb. Mitt.—"*Fiss. aeruginosus* H. f. & W., near Mount Albert, T. Kirk, 185 "—part of which must if there be anything in *F. aeruginosus*, belong here ; some of the stems are very short, with minute, exceedingly narrow and finely acuminate leaves, including fruiting-stems. But, on the other hand, there are plants of normal *F. tenellus* with it, and there are also intermediate forms showing, I think, clear intergrading between the two. The value of *F. aeruginosus* can only, it seems, be established by investigation in the field.

The treatment in the Handbook only serves to render the problem more obscure, as the plant is placed by an error among the species with "margin of leaf thickened and hyaline," and is not compared with *F. tenellus*.

§ *Amblyothallia* C. M.

12. **Fissidens pallidus** H. f. & W., Fl. N.Z., ii, 62, t. 83 (1855) ; Handb. N.Z. Fl., p. 407.

Syn. ? *F. Knightii* Reichdt. in Verz. d. KK. zool.-bot. Ges. in Wien, 1868 ; et in Novara Exped., Bot. i, 170.

F. pallidus is probably a rare species in New Zealand, but is found also in Tasmania and Australia ; specimens from all three countries are in the Kew collection. It appears to be common in some parts of Australia. It is a smaller plant than either of the two following species, and distinguished at once by the short stems, with pale, yellowish leaves, which are not much altered when dry except at their extreme tips, which are often circinately enrolled. Under the microscope it is easily known by the acute leaves, unbordered and with margins almost entire, the small rounded-hexagonal cells (6–10 μ in diameter) with firm walls, empty and colourless, the nerve pellucid and ceasing below apex. *F. asplenioides* and *F. oblongifolius* differ at once in the obtuse leaves ; *F. oblongifolius* var. *capitatus* is most like it, but differs in the deep green colour, much smaller cells, and stouter nerve.

The "Handbook of the New Zealand Flora" describes *F. pallidus* as having the "margin quite entire, nerve continuous to the apex"; but the apex of the leaf is often subdenticulate, and the nerve actually ceases distinctly short of the point.

I have not been able to see a specimen of *F. Knightii* Reichdt. The plant so named by Mitten at Kew is a *Bryoidium*, and belongs to *F. leptocladus*. I have, however, no practical doubt, from the description, that it is *F. pallidus*. The author only compares it with *F. capitatus* H. f. & W. (*F. oblongifolius* var. β), separating it by the dioicous inflorescence and the different leaf and capsule ("durch eine andere Blatt-und Frucht-form"). In these characters it agrees, however, with *F. pallidus*, with which it also accords, *e descr.*, in the colour, "*pallidi-virentes*," the cell-measurements, &c. The author also particularizes the highly cristate lamellae on the interior of the peristome-teeth, which is a marked character in *F. pallidus*. The only discrepancy is in the description of the cells as "chlorophyllosis," which hardly applies to ordinary mature plants of *F. pallidus*, but might be applicable to young plants. This apart, the species as described is in every detail identical with *F. pallidus*, and I think it quite safe to reduce it. The locality for *F. Knightii* was "Auckland; Knight."

13. **Fissidens oblongifolius** H. f. & W. in Lond. Journ. Bot., iii (1844), p. 547; Fl. N.Z., ii, 62, t. 83; Handb. N.Z. Fl., p. 407. Var. β **capitatus** H. f. & W., Fl. N.Z., *loc. cit.*

Syn. *F. Zurnianus* C. M., MS. in herb., et Gen. Musc. Fr., p. 68 (*nomen*).

I have examined the type of *F. Zurnianus* (Neu Seeland, *leg.* Zurn, 1882); it is certainly inseparable from the acute-leaved form of *F. oblongifolius*: I do not understand why C. Müller places it under § *Serridium*.

F. oblongifolius differs from *F. pallidus* in the chlorophyllose, small cells (5–8 μ), and other points as indicated under that species. It is more like *F. asplenioides*, but differs in the autoicous inflorescence, the leaves more rigid, much less crisped when dry, typically indeed little altered—but this is by no means constant—also, as a rule, the deeper green colour, and, according to the authors, the thinner seta and smaller capsule. The nerve in both species is stout, pellucid, and usually highly sinuose in the upper part; the margin apparently entire till viewed with a high magnification, when it is seen to be finely and regularly crenulate with the projecting cells.

The var. *capitatus* differs from the type in the leaf-apex being acute (but the character is often not well marked, and intermediate forms occur), and in the position of the male flowers, which is "terminal with the seta," while in the type the male flowers are axillary on the fertile stems.

Distrib.—New Zealand; Tasmania; Australia. I have examined specimens from "Paramatta, F. Müller," at Kew, which are quite correct, as well as Tasmanian specimens. They all belong to the type.

14. **Fissidens asplenioides** (Sw.) Hedw., M. frond. iii, 65, t. 28 (1801); Handb. N.Z. Fl., p. 406.

Syn. *Dicranum asplenioides* Sw., Fl. ind. occ., p. 1770 (1795). *F. ligulatus* H. f. & W., Fl. N.Z., ii, 63, t. 84.

I have not thought it necessary to give the full synonymy of this species, which is almost universally distributed through the subtropical regions of the Southern Hemisphere. The tall, slender, interrupted stems with the unbordered leaves strongly incurved-falcate when dry and often falcate in the moist state, the obtuse apex, dense opaque minute cells, and stout pellucid sinuose nerve, render it easy of recognition. *F. oblongifolius* type is the only species at all likely to be confused with it, and that differs, as has been pointed out, in the shorter stems, more rigid leaves, more chlorophyllose cells, and axillary male flowers, *F. asplenioides* being dioicous.

It is probably much more common in the North Island, but I have a specimen from as far south as Dunedin.

§ SERRIDIUM C. M.

15. **Fissidens adiantoides** (L.) Hedw., Fund. ii, 91 (1782); Handb. N.Z. Fl., p. 406.

This is the finest of the New Zealand species, and of very wide but rather peculiar distribution, as it is almost universally spread throughout the Northern Hemisphere, but in the Southern it is confined to New Zealand, Tasmania, and possibly southern Australia. I do not think there is any reason to doubt its presence at least in Tasmania, as its occurrence is undoubted in New Zealand, where it forms tufts—as in R. Brown's herbarium—fully 3 in. high, and fruiting abundantly.

Subgen. OCTODICERAS (Brid.) Mitt.

16. **Fissidens Mulleri** (Hampe) Mitt. in Trans. & Proc. Roy. Soc. Vict., 1883, p. 91.

Syn. *Conomitrium Mülleri* Hampe in Linn., xxviii (1856), p. 214. *Conomitrium Dillenii* Hook. f., Handb. N.Z. Fl., p. 408 (? *nec C. Dillenii* Mont.). *Octodiceras Mülleri* Jaeg., Adumbr. ii, 51. *Conomitrium aciculare* C. M., MS. in herb., et Gen. Musc. Fr., p. 71 (*nomen*).

I have accepted the commonly received view, that the New Zealand plant is different from the South American *Conomitrium Dillenii* Mont.; but in that case the Australasian distribution of the latter plant (as given, *e.g.*, in Par., Ind. bryol.) should be excluded.

C. Müller gives the name *C. aciculare* to the New Zealand plant (citing *C. Dillenii* H. f. as a synonym), but this does not differ in any way from the Australian *F. Mülleri*.

The plant is a perfectly distinct one in its aquatic habit, filiform, flaccid stems, and distant, blackish, long, narrow, and straight leaves. The fruit is very minute on a very short seta.

The species appears to be rare in New Zealand.

INCERTAE SEDIS.

Among some plants of *F. inclinabilis* which I received from Mr. D. Petrie, collected near Dunedin, I detected a few stems of a *Fissidens*, apparently of § *Bryoidium*, totally distinct from any Australasian species with which I am acquainted, having wide, broadly pointed leaves narrowly but distinctly bordered, with a narrow straight nerve, and the areolation very lax and absolutely pellucid, of regular, hexagono-rounded empty cells; and producing numerous large, green, elongate, jointed propagula among the leaf-axils. I have not found any fruit. It is without any doubt a highly distinct species, and quite possibly is *F. Zollingeri* Mont., which has a wide distribution in Indo-Malaya and Oceania, but it needs to be found in greater quantity before it can be properly placed.

A specimen in Wilson's herbarium at the British Museum, labelled simply “*Fiss. incurvus*, N.Z., Col.” (*i.e.*, Colenso), is possibly a different species of *Bryoidium* from any here included, having wider leaves with a stouter border and less obscure cells than *F. leptocladus*.

EXCLUDED SPECIES.

The “Handbook of New Zealand Flora” includes the following European species: *F. bryoides* Hedw., *F. viridulus* Wahl., and *F. incurvus* Schwaeg. I have examined the specimens on which these records are founded, both in Herb. Hook. at Kew and in Herb. Wils. at the British Museum. There are no specimens in either named *F. bryoides*, and this must certainly be expunged from the list.

There are several fragmentary specimens referred to *F. viridulus* and to *F. viridulus* var. *acuminatus* (or *F. acuminatus* H. f. & W., MS.).

F. acuminatus H. f. & W., W. 318, in Herb. Wils., is *F. campyloneurus* C. M. & Beck. The Kew specimen appears to contain only *F. tenellus*.

“*F. viridulus* var., Col., 2135, N.Zd.,” in Herb. Wils., is *F. inclinabilis* C. M.

“*Fiss. incurvus*, 2139, Col.,” in Herb. Hook., is *F. inclinabilis* C. M.

“*Fiss. incurvus*, W. 319,” is practically the same as W. 318 above referred to, containing *F. tenellus* only.

“N.Z., J. D. H., W. 335c,” in Herb. Wils., is *F. leptocladus* var. *Cheesemanii*.

“N.Z., J. D. H., W. 331,” in Herb. Wils., is *F. leptocladus* subspec. *gonioneurus*: but with the characters poorly marked as compared with C. Müller's type; the leaves falcate when dry, more distant. A single minute erect capsule is present. Several stems, each about 1 cm. long, and very regularly linear when moist.

“*Fiss.* nr. *incurvus*, N. Isld., N.Z., 1848, Col. Bolton, 23,” in Herb. Wils., is also *F. leptocladus* subspec. *gonioneurus*, but with the leaves spreading, longer; altogether confirming the view of its nearness to *F. leptocladus*.

“W. 319 (*a*),” in Herb. Wils., is *F. campyloneurus* C. M. & Beck.

“W. N.Zd., J. D. H., with W. 377,” in Herb. Wils., is *F. pallidus* Hook. f. & W.

CALYMPERACEAE.

Calymperes Sw.

Calymperes australe Besch. in Ann. Sc. Nat., 1895-96, p. 277.

I have examined the specimen in Bescherelle's herbarium, “Ile Raoul, Archip. des iles Kermadec, sur les arbres, *Sallé*, 1868.” Bescherelle points out some slight differences from *C. hyophilaceum* C. M., which I must confess I am not able to verify from his specimens. *C. hyophilaceum*, however, so far as is known, has not a very wide geographical distribution, and there is a big gap between its southerly limit (its area is given by Paris as Philippines, Borneo, Java, Sumatra) and the present station. I do not therefore think it desirable to reduce the present species to *C. hyophilaceum* without a more critical investigation than I have been able to give.

The principal interest of the plant lies in the fact that it probably marks the extreme southerly limit of the genus, which is almost entirely a tropical and subtropical one, and one which, with *Syrrhopodon*, has a curious predilection for insular and littoral regions without being really maritime. Its occurrence in the Kermadecs constitutes its only claim to be reckoned in the New Zealand flora. In habit and leaf-form it much resembles some of the smaller, short-leaved species of *Trichostomum*, but is at once known by the greatly and abruptly widened hyaline cells of the base (cancellinal cells), which is thereby rendered very white and shining.

POTTIACEAE.

The arrangement of this family by Brotherus (in Engler and Prantl, Pflanzenfam., Musci) appears to me a clear and natural one. Excluding Encalypteae, which I incline to think best treated as a separate family, the genera fall into three groups, distinguishable thus :—

♀ flower usually on a lateral branchlet. Capsule without stomata II. CINCLIDOTEAE.
♀ flower terminal. Capsule with stomata.
a. Leaves usually narrow, often linear-lanceolate, never broader in the upper half. Nerve usually with several Deuter, no Begleiter, and two stereid bands. Upper cells small and usually obscure, basal narrow .. .. I. TRICHOSTOMEAE.
b. Leaves usually wide, lingulate to spathulate. Nerve with two median Deuter, with Begleiter, and one stereid band. Upper cells usually larger, lower elongate, usually hyaline, often lax and wide III. POTTIEAE.

Of these groups, Cinclidoteae is absent from New Zealand. The genera under the other two may be grouped as follows :—

TRICHOSTOMEAE

A. Capsule cleistocarpous .. .. *Astomum.*
B. Lid separating.
a. Peristome wanting.
* Columella attached to and falling with the lid .. *Hymenostylium.*
** Columella not falling with the lid.
Leaf-margin incurved, mouth of capsule closed by a membrane *Hymenostomum.*
Leaf-margin plane or recurved, capsule not closed by a membrane *Gymnostomum.*
b. Peristome present (rarely wanting in *Weisia*).
a. Teeth not twisted, usually short.
* Leaves wide below, acute or acuminate.
Stems filiform, leaves in three rows, highly and densely papillose, entire .. .. .. *Triquetrella.*
Leaves squarrose, serrulate above ; plant robust *Leptodontium*
** Leaves narrow, or, if wider, obtuse at apex.
Leaves small, narrow, soft, peristome-teeth small *Weisia*
Leaves very rigid, extremely narrow, nerve very stout, margin plane .. .. .. *Eucladium.*
Robust ; leaves widely lingulate, obtuse and subcucullate ; cells smooth ; capsule large, short and wide, turbinate when empty ; peristome-teeth (16) wide, 2–3-fid .. .. *Tridontium.*
Capsule oblong to cylindrical, leaves recurved at margin *Didymodon.*
β. Peristome-teeth long, spirally twisted.
Leaf-margin plane or incurved .. .. .. *Tortella.*
Leaf-margin usually recurved .. .. .. *Barbula.*

POTTIEAE.

A. Capsule cleistocarpous .. .. *Acaulon.*
B. Lid separating.
  a. Calyptra campanulate (until maturity at least), enclosing the capsule; plants small .. .. *Hennediella.*
  b. Calyptra mitriform, covering upper part of capsule only; robust plant; leaves bordered .. .. *Calyptopogon.*
  c. Calyptra cucullate.
    α. Upper part of ventral surface of nerve covered with long filamentous lamellae .. .. *Crossidium.*
    β. Nerve normal.
      Capsule short, oval or elliptic, peristome failing or teeth short, often rudimentary; plants small .. .. *Pottia.*
      Capsule cylindric or oblong-cylindric, peristome-teeth long, spirally twisted; plants often robust .. .. *Tortula.*

I. TRICHOSTOMEAE.

ASTOMUM Hampe (*Phascum* Hedw. ex p.: *Systegium* Schimp.).

Astomum austro-crispum (C. M. & Beck.) Broth. in Engler and Prantl. Pflanzenfam., Musci, i, 384 (1901).

Syn. *Phascum austro-crispum* C. M. & Beck. in Trans. N.Z. Inst., vol. 26, p. 274, tab. 25 (1894). *Phascum lanceolatum* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 302. *Pleuridium lanceolatum* Par., Ind., p. 972.

A widely distributed species, I should judge. Readily known among the Phascoid mosses by the Weisioid leaves, much curled when dry, longly linear with mucronate or cuspidate points, minute isodiametric upper cells, and upper margins usually strongly incurved.

Var. nov. **longifolium** (R. Br. ter.) Dixon.

Syn. *Phascum longifolium* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 303 (1894). *Pleuridium longifolium* Par., Ind., p. 972 (1897).

Robustius: foliis superioribus praelongis (4–5 mm.): theca et operculo longioribus.

Hab.—On wet clay, Lyttelton Hills; coll. R. Brown; type in Brown's herb. I do not know of any other locality for this well-marked variety.

HYMENOSTOMUM R. Brown.

Hymenostomum patulum (Knight) Dixon comb. nov.

Syn. *Gymnostomum patulum* Knight in Trans. N.Z. Inst., vol. 7, p. 354, tab. 28 (1875) (*nec G. patulum* Wils., MS. ined., in Handb. N.Z. Fl., p. 404). *Gym. tortile* Hook. f. & W., Fl. N.Z., ii, 59; Handb. N.Z. Fl., p. 403 (*nec* Schwaegr.). *Hymenostomum neglectum* Hampe, MS. in herb. *Gym. longirostrum* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 300 (1894). ? *Gym. magnocarpum* R. Br. ter. *op. et loc. cit.* ? *Gym. Wrightii* R. Br. ter., *op. et loc. cit.*

A somewhat variable plant in the leaf characters, which has given rise to much confusion, and has, I think, without doubt led to the multiplication of species by R. Brown indicated in the synonymy. Unfortunately, there are scarcely any specimens of *Gymnostomum* in his herbarium, but a careful study of the descriptions and figures in the volume cited above shows, I think with little doubt, that he is there merely describing as distinct species slightly differing forms of this plant—*G. Wrightii*, *e.g.*, being the frequent form with very oblique asymmetrical capsules. Similar forms occur in the European *Hymenostomum microstomum*.

The only species with which it is likely to be confused is the gymnostomous form of *Weisia viridula*. That, however, is readily distinguished by the longer, very yellow seta, the capsule more brightly coloured when ripe and with a red rim, the mouth not closed by a membrane, the beak of the lid more slender and less strongly decurved, the leaves narrower and more delicate, the perichaetial ones usually considerably longer than the ordinary leaves, while in *H. patulum* they are usually about equal, or shorter.

H. patulum is marked by the dull colour of the capsule, on a quite short seta, the mouth closed, at the fall of the lid, by a membrane—this being the principal generic character—the lid with a long, stout beak, usually as long as or longer than the capsule, and bent downwards at right angles or even decurved. In this, as well as in the leaf-margin only incurved above, not enrolled, and in the weaker, less reddish nerve, it differs from the *H. tortile* of Europe, and is, indeed, perhaps more nearly allied to *H. microstomum*.

I have seen no specimen of *Gymnostomum patulum* Knight, but there can be no doubt from the description and figures that he is describing the plant referred by Hooker and Wilson to *G. tortile*; it appears to be a common species in New Zealand. I have examined the specimens in Wilson's herbarium on which the above determination was made, and have no doubt that they may all be referred either to this austral species (*e.g.*, "H. 306. N.Z. — ? *Hymenostomum patens* Wils. MS."; "Col. 364"; and "Col. 215 *p.p.*"), or in the case of others to the plant described below as *Weisia viridula* var. *gymnostoma* (Hook. 305, N.Z.).

Trichostomum subuliferum Mitt. MS. in herb. (N.Z., Travers, 1860) also belongs here, as does *Hymenostomum neglectum* Hampe MS. in herb.

R. Brown ter., in some pertinent notes on Knight's species of *Gymnostomum* (Trans. N.Z. Inst., vol. 26, p. 297), calls attention to the fact that Wilson had already proposed the name *G. patulum* for the gymnostomous form of *Weisia viridula*, and that Knight does not make it clear whether it is this particular moss or another species which he describes as *G. patulum*. It is, I think, certain that Knight did not intend to describe Wilson's moss, and that his species is distinct; but the choice of name is certainly unfortunate. Brown's name, *G. longirostre*, would be much more descriptive; but Wilson's *G. patulum* cannot be held to be validly published, not being accompanied by a description, and Knight's name must therefore stand.

The leaves are usually decidedly broader than in *W. viridula*; the apex varies greatly in degree of acuteness, and the nerve in the extent of its excurrence; the margins may be quite plane, but, as a rule, the leaves are more or less concave above with the margins erect, and the uppermost may often have them distinctly and rather widely incurved, so that the apex becomes subcucullate. The areolation is dense and obscure, while the nerve, near the apex at least, is much more translucent.

WEISIA Hedw.

A genus difficult of definition, passing almost indefinably into *Trichostomum* on one side, and on the other into *Hymenostomum*. From the latter it differs in the capsule peristomate, or, if gymnostomous, not having the mouth closed by an epiphragm; from *Didymodon* and *Trichostomum* principally by the usually shorter capsule and the less-developed peristome, the teeth not springing from a basal membrane, mostly short, wide at base, not filiform, somewhat nodose, often perforate or irregular, frequently papillose. The leaf-margin is usually erect or incurved, rarely recurved.

KEY TO THE SPECIES.

1.	Leaf-margin incurved above, nerve excurrent, cells minute, obscure	2
	Leaf-margin plane or slightly reflexed below, nerve vanishing below the obtuse apex, cells rounded, distinct and usually pellucid ..	2. *Weymouthii.*
2.	Peristomate	1. *viridula.*
	Gymnostomous	1. var. *gymnostoma.*

1. Weisia viridula (L.) Hedw., Fund. ii, 90 (1781).

Syn. *Bryum viridulum* L., Sp. Pl., ii, 1119. *W. controversa* Hedw., Descr. iii, 12 (1792); Handb. N.Z. Fl., p. 404. *W. flavipes* H. f. & W., Fl. N.Z., ii, 59; Handb. N.Z. Fl., p. 404. *Trichostomum sciophilum* C. M. in Hedw., xxxvii, 119 (1898). *Trichostomum mutabile* H. f. & W., Fl. N.Z. ii, 72; Handb. N.Z. Fl., p. 416 (*nec* Bruch).

Nov. var. **gymnostoma** Dixon. Theca omnino gymnostoma.

Syn. *Gymnostomum patulum* Wils., MS. in Handb. N.Z. Fl., p. 404 (*nomen*). *G. inflexum* Tayl. in Lond. Journ. Bot., v (1846), p. 43. *Weisia inflexa* Mitt. in Trans. & Proc. Roy. Soc., Victoria, 1882, p. 58. *Hymenostomum inflexum* Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 386. ? *Gym. ligulatum* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 299. ? *Gym. waimakaririense* R. Br. ter., *op. et loc. cit.* ? *Gym. Stevensii* R. Br. ter., *op. et loc. cit.*

I follow Max Fleischer in referring the southern *W. flavipes* to the same species that occurs so widely in the Northern Hemisphere. In the "Handbook of the New Zealand Flora" Hooker includes both species, separating them on very slight differences, chiefly of the peristome (perforated in *flavipes*, nearly entire in *controversa*—*i.e.*, *viridula*); but the peristome in *W. viridula* is one of the most variable in the whole range of mosses, and far greater differences than those here suggested are found among the European forms of *W. viridula*. In the leaves it differs but little from *Hymenostomum patulum*, but the longer, bright-yellow seta, the capsule yellowish when young, bright brown and striate when mature, with a red orifice, with long and fine oblique beak to the lid, make it very distinct in fruit, even in the gymnostomous form. The lid varies in length, but is usually very long, and more slender and acute than in *H. patulum*.

The gymnostomous plant which I have here described as a variety has given rise to much of the synonymy cited above; it differs, however, in no other way from the type (though perhaps tending to have a shorter capsule); and I have had both forms sent in the same gathering from Mauriceville, Wairarapa, by Mr. Gray, forming separate tufts, but not manifesting any other differences. Judging from considerable material sent me by Mr. D. Petrie, it would appear to be very common in the neighbourhood of Auckland, perhaps more so than the type.

I have examined original specimens of *Gymnostomum inflexum* Tayl. (Swan River, Drummond), and I cannot separate them in any way from this plant (the gymnostomous form). Wilson compares it with *W. mucronata*, and Brotherus places it in the section of *Hymenostomum* with leaf-margins flat. I find them, however, quite sufficiently often incurved to present no difficulty in including the plant here; the capsule and seta quite agree.

The description of C. Müller's *Trich. sciophilum* leaves no doubt in my mind that he is describing one or other of the forms of this species (the peristome was not found).

I have not much hesitation in referring here the three species of Brown's published in Trans. N.Z. Inst., vol. 26, but as specimens are not available the matter cannot be definitely settled. *G. westlandicum* of the same author may quite probably belong here also.

The plant figuring as *W. crispula* Hedw. in R. Brown's herbarium, and described and figured by him in the paper in Trans. N.Z. Inst., vol. 31, belongs to *W. viridula*. The plant so called in the Handb. N.Z. Fl., on the other hand, refers to the *Weisia crispula* of Hedw. Sp. M. (*Dicranoweisia crispula*), and is *Dicr. antarctica*.

A plant of Hooker's collecting, "H. 305, N. Zealand," in Herb. Wils., also belongs to the var. *gymnostoma*.

I have examined the specimen of "*Trichostomum mutabile*, N.Zd., Colenso, 2144*b*," in Wilson's herbarium, on which Wilson has noted "*Weisia* allied to *controversa* but different." It is a tall, robust plant, with stems 1·5 cm. high, leaves large and wide, margin erect in the lower leaves, incurved in the upper; in size about equal to those of *W. mucronata* B. & S., or *Hymenostomum tortile* B. & S. The sporophyte appears to agree exactly with *W. viridula*; Wilson has sketched the peristome-teeth as short and very narrow. It is certainly not *Trich. mutabile*, and I think may safely be referred here. Wilson has remarked that the imperfect peristome renders it difficult to distinguish from *Gym. tortile* (*Hymenostomum tortile* B. & S.), which alone would indicate its position as being in *Weisia*. Forms of *W. viridula* with wide leaves are not rare in Europe, but they are usually associated with short, wide, truncated peristome-teeth (var. *amblyodon* B. &. S.). I have, however, seen specimens of var. *densifolia* B. & S. which differed very little from the New Zealand plant in question, and it might, I think, almost be referred to that variety; but that was described by the authors as having *narrow* leaves, and is usually also associated with a short seta and small capsule, so that it is best perhaps to consider our plant as a somewhat indeterminate form, sharing the special features of more than one of the named varieties, without being quite referable to any.

W. viridula is no doubt common in New Zealand.

2. **Weisia Weymouthii** R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 439, t. 38 (1899). [*nec Weisia Weymouthii* C. M. *e* Rodway, Tasman. Bryophyta, Mosses, p. 19 (1914)].

Syn. ? *Gymnostomum angustatum* Knight in Trans. N.Z. Inst., vol. 7, p. 355 (1875). *Trichostomum Cockaynii*, p.p. R. Br. ter., *op. cit.*, vol. 29, p. 486. *Trich. gracile* R. Br. ter. *op. et loc. cit.* *Weisia ? Searellii* R. Br. ter., *op. cit.*, vol. 35, p. 329 (1902).

I feel some doubt as to the position of this plant, but am inclined to let it stand in *Weisia*. The uncertainty arises partly from the great variability of several characters, partly from the imperfection of the material available, especially as regards the peristome. The type specimen in R. Brown's herbarium shows scarcely a trace of peristome, but what there is seems to be clearly Weisioid. That of *Trichostomum Cockaynii* contains a mixture of *Barbula australasiae* with a few stems of a moss which I take to be identical with *W. Weymouthii*, but the peristome-teeth are longer and narrower, and shortly filiform above, while the leaf-structure shows some slight difference. The leaf-margin is usually plane, but occasionally slightly reflexed below, often on one side only; and there is a considerable resemblance in many respects to the European *Didymodon tophaceus* (Brid.) Jur. The peristome, however, appears to be certainly Weisioid, and I believe that it is in its proper place in this genus.

The typical plant may be known with the lens almost at sight by the spreading leaves, lingulate in outline, and usually very obtuse at apex (occasionally narrowed and subobtuse only), the nerve ceasing some distance below the tip; the cells are rounded, pellucid and distinct, usually somewhat incrassate; at base rather elongate-rectangular, with the walls usually firm and coloured; but occasionally laxer in character. The nerve is almost always slightly muriculate at back below the apex, and occasionally strongly roughened almost to the base. The cells are sometimes more obscure, and at times less incrassate than usual.

Dicranum Huttonii R. Br., ter., MS. in herb., consists of a single unlocalized tuft of a plant which I think identical with *W. Weymouthii*. It has, however, a rather wider capsule, a somewhat different peristome—the teeth being wider, united at base, more regularly and finely papillose—and the spores only measure 15–20 μ, while those of *W. Weymouthii* are 25–30 μ. In spite of these somewhat marked differences I am inclined to refer it to this species, which, however, needs further elucidation.

The var. β R. Brown ter., "larger in all the parts," emphasizes the variability of the species, but is, I think, hardly worth maintaining.

From the description and figures of *Gymnostomum angustatum* Knight I am strongly inclined to consider it identical with the present plant (the peristome might easily be overlooked), in which case the name would have priority over R. Brown's. In the absence of specimens, however, the change of name can hardly be safely made.

Trichostomum gracile R. Br. ter. is certainly the same thing. The specimen in Brown's herbarium is labelled *Tr. gracillimum*, but its position and number in his arrangement leave scarcely a doubt of its identity with the plant published as *Tr. gracile*.

Rodway, on p. 19 of his Tasmanian Bryophyta (Mosses), describes a *Weissia Weymouthi* C. M., a name which I am unable to trace in any publication. The Gen. Musc. Frond. does not throw any light, as for some reason or other neither the genus *Gymnostomum* nor *Weisia* is to be found there. I conclude, therefore, that it is a MS. name of C. Müller's, probably in Weymouth's herbarium (no locality or collector is given). From the description I should judge the plant to be either a *Hymenostomum* or, with great probability, the gymnostomous form of *W. viridula*. If retained in *Weisia* the name will need changing in view of R. Brown's earlier published name.

Trichostomum gracile R. Br. ter. antedates *Weisia Weymouthii* R. Br. ter., but as no plants actually labelled *T. gracile* by Brown have been seen, and in view of a combination *Weisia gracilis* Spreng. already existing, I have thought it best to retain the name which can be certainly identified.

Weisia? Searellii R. Br. ter. is a very compact, brown, small-leaved form, but exhibits no structural differences.

Dicranum kowaiense R. Br. ter. is certainly referable here. Brown remarks that it was growing with *D.* (*Tridontium*) *tasmanicum*, which it approaches in all characters except its size; a remark which applies very aptly to *W. Weymouthii*, which might be described as a miniature of *T. tasmanicum*, but with larger pellucid cells and more elliptic capsule.

Var. nov. **lancifolia** (R. Br. ter.) Dixon. Areolatio *magis obscura*, e cellulis *distincte minoribus*, subopacis instructa: folia *plerumque erecto-patentia*, vix recurvata.

Syn. *Dicranum lancifolium* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 458 (1896). *D. kowaiense* R. Br. ter., *op. cit.*, vol. 35, p. 330 (1902). *Gymnostomum Brotherusii* R. Br. ter., *op. cit.*, vol. 35, p. 327 (1902).

The name *lancifolium* is a most unsuitable one for the variety, but it appears to be the earliest published name for the plant, and must be retained. The small, obscure upper cells and the leaves, short, erect and rigid, not recurved, are the principal characters, and when well marked give the plant a very different appearance from the normal forms; but intermediate states occur, and in a few cases these are not easy to place.

The peristome in *W. Weymouthii* shows a very considerable range. Usually, it appears, the teeth are pale, fragmentary, very irregularly divided and connected, and smooth or very finely papillose. At other times they are yellow, and rather coarsely granulate; and in one plant, which seems to belong to the variety, they are fairly regularly divided into two long filiform crura.

The typical form and the variety occur in Brown's herbarium under numerous names and from various localities. I have also received it from Mr. G. Webster (No. 958), collected by S. Chadwick at Waikopiro, Hawke's Bay, North Island.

EXCLUDED SPECIES.

W. acutifolia R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 438 = *Barbula australasiae* (Hook. & Grev.), *p.p.*, and *Gymnostomum calcareum* var. *longifolium p.p.*

W. torlessensis R. Br. ter., *op. cit.*, p. 439 = *Gym. calcareum* var. *longifolium.*

W. Petriei R. Br. ter., *op. cit.*, p. 440 = *Eucladium irroratum.*

W. Webbii R. Br. ter., *op. cit.*, p. 440 = *Dicranoweisia antarctica.*

W. Brotherusii R. Br. ter., *op. cit.*, p. 441 = *Pseudodistichium Brotherusii.*

W. kaikouriensis R. Br. ter., *op. cit.*, vol. 35, p. 328. Almost certainly = *Barb. australasiae.*

W. crispula Hedw. (Handb. N.Z. Fl., p. 404) = *Dicranoweisia antarctica.*

W. irrorata Mitt. = *Eucladium.*

W. contecta H. f. & W. = *Blindia.*

W. rufa Stirt. (*cf.* Buchanan in Trans. N.Z. Inst., vol. 6, p. 210) is apparently a *nomen nudum.*

GYMNOSTOMUM Hedw.

This genus, which at one time formed the dumping-ground of practically every gymnostomous moss, has now been reduced until, under Brotherus's system, it retains only six species. It differs from *Hymenostomum* in not having the capsule-mouth closed by an epiphragm; from gymnostomous forms of *Weisia* in the flat-margined leaves, not much crisped when dry, with nerve ceasing below the apex. The species are generally inhabitants of wet calcareous rocks

Gymnostomum calcareum Bry. germ. (1823); Handb. N.Z. Fl., p. 403 (*non Seligeria calcarea* B. & S.).

Syn. *Weisia calcarea* C. M., Syn. i, 659. *Gymnost. pygmaeum* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 298. *G. Salmonii* R. Br. ter., *op. cit.*, vol. 35, p. 327. *G. Parisii* R. Br. ter., *op. et loc. cit.*, p. 328. *Trichostomum linearifolium* R. Br. ter., *op. cit.*, vol. 29, p. 485.

Nov. var. **longifolium** Dixon. Folia *praelonga, angustissime ligulata, recurva,* plerumque acuta.

Syn. *Gym. Gibsonii* R. Br. ter., *op. cit.*, p. 327. *Weisia torlessensis* R. Br. ter., *op. cit.*, vol. 31, p. 439. *W. acutifolia* R. Br. ter., *op. cit.*, p. 438, *p.p.* ? *Eucladium tasmanicum* Broth. *e* Rodway, Tasman. Bryophyta, Mosses, p. 20 (1914).

Hab. Waikopiro, Hawke's Bay, *leg.* S. Chadwick, comm. G. Webster, No. 959; Mount Torlesse, *leg.* R. Brown; and other localities. Mount Wellington, Tasmania, *leg.* Lodden, comm. G. Webster, No. 884.

This very variable but usually easily recognizable species is always found on calcareous rock or soil, which it clothes with a dense compact cushion or mat, the lower part of the stems being generally encrusted with calcareous accretion. When this is not the case the density of the stems, interwoven with radicles, is so great that the older part of the plant frequently develops a solid, corky consistency. The surface is usually (unless desiccated) of a very vivid green. By these characters the plant may usually be recognized at sight. There is, however, a good deal of variation in some characters, and this no doubt has given rise to a number of the species which I have felt obliged to relegate to the synonymy of the present plant. The leaves are very minute, narrow, ligulate or linear, with a stout nerve ceasing below the apex, and small, papillose, often rather obscure upper cells; the apex often obtuse and rounded, but frequently apiculate or distinctly acute; the leaves may be erecto-patent or strongly recurved; the latter is the case with the var. *longifolium*, where they are very elongate and usually acute; but obtuse and acute leaves may be found on the same stem, and intermediate forms connect it with the type. The leaves of *G. calcareum* are stated by Boulay to measure 0·75 mm. in the typical form (*i.e.*, with long, narrow leaves—in other forms they are much shorter); in var. *longifolium* they frequently reach 1·25 mm.

Although dioicous, the plant is often found fruiting freely, and this, I think, may have caused R. Brown to describe as monoecious the four species in his paper "On the Musci of the Calcareous Districts of New Zealand" in volume 35 of the Transactions which I have referred here. Apart from this character there is nothing in either description or figures to suggest any distinction either from *G. calcareum* or from one another, and I suppose that the author did not recognize the great variability of the species. In the same way *G. pygmaeum* is, I have no doubt, simply the acute-leaved form of the ordinary plant.

Hooker was in error, in the Handbook, in stating that *G. calcareum* was identical with *Seligeria calcarea* B. & S., which is a quite different plant.

Weisia torlessensis R. Br. ter., from the author's specimen, is certainly this species (this, too, is described by him as monoecious); it is referable to var. *longifolium*, though not so strongly marked a form of this as some I have seen.

Rodway describes (*cf.* Synonymy) a sterile moss from Tasmania, from the description of which I strongly suspect it to be the same varietal form of this plant.

Knight described (in Trans., vol. 7) a var. *intermedium*, without apparently being aware of the already existing var. *intermedium* Schimp. As, however, it does not appear to possess any very marked characters it had perhaps better be dropped rather than renamed.

INCERTAE SEDIS.

Gymnostomum westlandicum R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 328. This may be the gymnostomous form of *Weisia viridula*, but I do not feel at all sure about it: the description and figures do not give much aid.

EXCLUDED SPECIES.

G. patulum Knight = *Hymenostomum.*

G. Knightii Schimp. = *Didymodon lingulatus.*

G. sulcatum Knight = *Zygodon sulcatus.*

G. areolatum Knight = *Pottia areolata.*

G. angustatum Knight = *Weisia Weymouthii.*

G. Brotherusii R. Br. ter. = *W. Weymouthii* var. *lancifolia.*

G. magnocarpum R. Br. ter., *G. Wrightii* R. Br. ter., *G. longirostre* R. Br. ter., and *G. tortile* Hook. f. (Handb. N.Z. Fl.). = *Hymenostomum patulum.*

Further excluded species will be found in the synonymy of *G. calcareum* and of *Weisia viridula* var. *gymnostoma.*

Paris, Index, ed. ii, cites *G. calcareum* var. *australe* Broth. & Geh. from N.Z. The reference, however, is erroneous; the variety was collected in Australia.

HYMENOSTYLIUM Brid. emend. Lindb.

A genus separated by Lindberg from *Gymnostomum* by the stem three-angled in transverse section, without central strand; the leaves very little curled when dry, usually rather rigidly incurved, the capsule somewhat pachydermatous and glossy, and especially by the long beaked lid remaining attached to the columella, by which it is often held in its place long after detachment at the rim, as in *Pottia Heimii*, and which ultimately falls with it. The type of the genus is the following species, now recorded for the first time from New Zealand.

H. curvirostre (Ehrh.) Lindb. de Europ. Trichost., p. 230 (1864).

Syn. *Pottia curvirostris* Ehrh. Pl. crypt. n. 93 et in Beitr., i, 188 (1787). *Gymnostomum curvirostre* Hedw. Descr., ii, 68 (1789), et Sp. M. p. 33 (1801).

While this paper was in preparation I received a number of New Zealand mosses from Mr. Petrie, including several from Mount Ida, Maniototo County, Otago; among them were several tufts of *Hymenostylium*, which I am quite unable to separate from this species, frequent and widely spread throughout the Northern Hemisphere. It has not hitherto been recorded from the Southern Hemisphere; but I am strongly inclined to suspect that *H. longopulvinatum* Duo. from Patagonia may prove to be the same thing. It is remarkable that Mount Ida is also the only known habitat in New Zealand (and, indeed, in the Southern Hemisphere) for *Saelania glaucescens*, as well as for several other rare New Zealand species.

H. curvirostre is generally recognizable by the fruit, which is glossy, pachydermatous, when empty and deoperculate, gradually tapering downwards from the rather wide mouth to the long well-marked neck of the capsule. The leaf also is characteristic, and when once known easily recognized, although manifesting a great variety of cell-structure; the cells may be smooth or highly (but finely) papillose, elongate or isodiametrical; but are usually rather large in comparison with the allied plants, clear and well defined. The leaves are markedly carinate, generally tapering from some distance below the apex to a rather blunt point, and the margin (often one only) is usually rather indistinctly reflexed near the base. Not unfrequently the cells, back of nerve, and the stem between the leaves are all markedly papillose (var. *scabra* Dixon); in the Mount Ida plant the nerve is finely scabrous at back, but it cannot be brought under that variety.

EUCLADIUM Bry. Eur.

Eucladium irroratum (Mitt.) Par., Ind., p. 438 (1894). [Plate VIII, fig. 1.]

Syn. *Weisia irrorata* Mitt. in Handb. N.Z. Fl., p. 403 (1867).
W. Petriei R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 440 (1899).
Dicranum Gulliverii R. Br. ter., *op. cit.*, vol. 29, p. 459 (1897).
Tetracoscinodon Hectori R. Br. ter., *op. cit.*, vol. 28, p. 532 (1895).

This very distinct plant appears to be rare. The type exists only in small quantity in Mitten's herbarium (North Island, coll. Stephenson, the locality being unspecified). *W. Petriei* was recorded by R. Brown from "Marshy ground near Mount Pembroke," where it was collected by Mr. D. Petrie, and the specimen in his herbarium agrees exactly with Mitten's type of *E. irroratum*. A further specimen in Mr. Petrie's herbarium is labelled "near L. Wanaka, Pembroke," and in Beckett's hand is named "*Tridontium tasmanicum* var. *β angustatum*." This is certainly the same plant as R. Brown's specimen. This locality is in the South Island. I have further received it from Mr. W. Gray as "*Tridontium tasmanicum*, narrow-leaved form," gathered at Hastwell Wairarapa, North Island, September, 1913 (No. 167), and January, 1914 (No. 201). Mr. Gray writes that it was covering two or three square yards of a steep wet bank, on the side of a small stream, overhung by small trees. His specimens are much more robust than the others, with larger, wider leaves, considerably enrolled when dry, more spreading when moist, a longer and narrower capsule, with the beak of the lid shorter and stouter; but the structural characters do not seem to show any distinctions that would justify its separation from *E. irroratum*.

The species is readily known by its very rigid, straight leaves, the long stout seta (varying from $\frac{1}{2}$ in. to $\frac{3}{4}$ in.) with rather large pachydermatous, castaneous capsule, when old blackish and often rather widely turbinate. The leaves taper, sometimes gradually, sometimes abruptly, from a wide subtriangular base to a long linear subula, scarcely narrowed to the very apex, where it is rounded and obtuse; the stout prominent orange nerve filling a large part of the width. The upper cells are rounded and incrassate, the margin crenulate and papillose. *Tridontium tasmanicum* has much wider, less rigid leaves, the nerve very much narrower, especially in proportion to the width of the leaf, a thickened margin, &c.

Like the *E. verticillatum* of Europe, *E. irroratum* appears to prefer a wet calcareous substratum, and the stems are usually encrusted at the base with calcareous matter.

After careful examination I am very reluctantly obliged to conclude that *Tetracoscinodon* R. Br. ter. must be referred here. A glance at the description and figures of that plant will show that there is nothing to separate it in either the vegetative or the sporophytic characters except the remarkable peristome, which is described and figured as consisting of "four triangular irregularly-perforated teeth, the perforations being covered by an extremely thin transparent membrane, which is readily seen on staining the peristome."

The peristome in *E. irroratum* consists of short, very irregular teeth, broad at the base and often practically united there, very thin and pellucid, with clearly defined narrow transverse articulations; they are irregularly thickened above, the thickened parts being connected by the thin hyaline layer (the thin transparent membrane of Brown's description). In all this they agree with the *Tetracoscinodon* peristome, which, however, purports to be distinct (*a*) in the moniliform arrangement of the articulations as figured by Brown, (*b*) in the teeth united in fours. As regards (*a*), Brown has certainly exaggerated the tendency to a moniliform arrangement of the segments; the type gathering in his herbarium (in other respects precisely identical with the smaller forms of *E. irroratum*) shows the articulations much more rectangular than figured precisely, indeed, as figured by Brotherus (Engl. & Prantl, Musci., p. 401). As regards (*b*), this is no doubt a striking feature, and one which, were it constant, might well constitute a generic character. Brown's own type specimens, however, show it to be quite inconstant, and in fact abnormal. In the capsules I have observed they are quite irregularly grouped, sometimes in fours, at others in threes, occasionally in twos. Moreover, in other specimens of *E. irroratum* I have found the teeth in one peristome joined four together, while others in the same peristome are joined only in twos, one pair of these couples being in one instance *nearly* united together. The same remarkable variation occurred in the type specimen of *Dicranum Gulliverii* R. Br. ter., which must also be referred here.

Trichostomum Hedw.

This formerly most comprehensive genus has now been whittled down until none of the New Zealand species formerly referred to it can be allowed to remain. It will probably be found useful to indicate briefly the present position of plants formerly placed here.

Handb. N.Z. Fl. :—
T. leptodum Mitt. = *Thysanomitrium.*
T. lingulatum H. f. & W. = *Didymodon.*
T. phaeum H. f. & W. = *Tortula.*
T. mutabile = *Weisia viridula.*
T. rubripes Mitt. = *Tortella.*
T. laxifolium H. f. & W. = *Ditrichum flexifolium.*
T. elongatum H. f. & W. = *Ditrichum.*
T. setosum H. f. & W. = *Ditrichum flexifolium.*
T. australe Mitt. = *Ditrichum strictum.*
(R. Br. ter. in Trans. N.Z. Inst., vol. 29, pp. 478 *et seq.*)
T. falcatum R. Br. ter. = *Dicranum aucklandicum.*

Brown's specific name could not have been employed in this case, even had the identity of his species with Mitten's plant been recognized at the time of publication, since the name *falcatum* is, of course, antedated by *Dicranum falcatum* Hedw.

T. calcareum R. Br. ter. = *Ditrichum.*
T. radiculosum R. Br. ter. = *Ditrichum brevirostrum, p.p.*
T. brevirostrum R. Br. ter. = *Ditrichum.*
T. avonense R. Br. ter. = *Tortella Knightii.*
T. Buchanani R. Br. ter. = *Pseudodistichium.*
T. filiformifolium R. Br. ter. = *Ditrichum punctulatum.*
T Hallii R. Br. ter. = *Dicranum trichopodum.*
T. Moretonii R. Br. ter. = *Holomitrium perichaetiale.*
T. minutifolium R. Br. ter. = *Tortula atrovirens.*
T. apiculatum R. Br. ter. = *Tortula atrovirens.*
T. Searellii R. Br. ter. = *Tortula atrovirens.*
T. ligulatum R. Br. ter. = *Pottia Stevensii, p.p.*
T. rostratum R. Br. ter. = *Barbula.*
T. linearifolium R. Br. ter. = *Gymnostomum calcareum.*
T. Cockaynii R. Br. ter. = A mixture of *Barb. australasiae* and *Weisia Weymouthii.*
T. gracile R. Br. ter. = A mixture of *Barb. australasiae* and *Weisia Weymouthii.*
T. Binnsii R. Br. ter. = *Didymodon.*
T. repandifolium R. Br. ter. = *Tortella Knightii.*
T. contortifolium R. Br. ter. = *Tortella Knightii.*
T. curvithecium R. Br. ter. = *Didymodon rubellus.*
(R. Br. ter., *op. cit.*, vol. 35, p. 331.)
T. Whittonii R. Br. ter. = *Didymodon rubellus.*
T. sciophilum C. M. = *Weisia viridula.*
T. grossirete Broth. & Dixon = *Tortula flavinervis.*

INCERTAE SEDIS.

T. Stanilandsii R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 330; *T. kanieriense* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 331. The description and figures of these two species are too general to make it possible to identify them, but do not appear to indicate any characters that would justify their maintenance as species.

T. Theriotii R. Br. ter., *op. cit.*, p. 331. Probably *Didymodon lingulatus.*

T. mokonuiense R. Br. ter., *op. cit.*, p. 332, is probably *Barbula australasiae.*

T. intermedium R. Br. ter., MS. in herb., is *Tortula atrovirens.*

TRIQUETRELLA C. M.

Triquetrella papillata and a few allied species were separated from *Didymodon* (and *Leptodontium*) by C. Müller, principally on account of their very marked habit, triquetrous leaf-arrangement, and densely and highly papillose areolation. Most of the species are closely allied, and it is perhaps an open question how far they may be racial forms of one species. The recent discovery of a species—again slightly differing—in Spain, and still more recently in Portugal, gives an interesting but puzzling extension to the range. The genus is a very natural one.

KEY TO THE SPECIES.

Leaves widely cordate, abruptly narrowed to a short, variously acute point; papillae very high and dense .. .. 1. *papillata.*

Leaves ovate-lanceolate, more gradually tapering to a longer, acute acumen; papillae much lower and less conspicuous .. .. .. 2. *filiformis.*

1. **Triquetrella papillata** (H. f. & W.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 399 (1902).

Syn. *Didymodon papillatus* H. f. & W., Fl. N.Z., ii, 73, t. 85 (1855); Handb. N.Z. Fl., p. 421.

T. papillata is readily known from the other species of Pottiaceae and of *Zygodon* by the elongate, filiform, subrigid stems, bright yellowish-green colour, triquetrously set, widely ovate-cordate, shortly pointed leaves, densely and highly papillose throughout on both surfaces. The fruit resembles *Trichostomum*, on a very slender, pale seta, with an irregular peristome, the teeth variously cleft and often anastomosing.

It appears to be widely distributed in New Zealand, most frequently sterile, and occurs in Tasmania and Australia.

2. **Triquetrella filiformis** C. M. in Oesterr. bot. Zeitschr., 1897, n. 11-12.

Among a number of duplicates of New Zealand mosses sent me from the New York Bot. Gard., from Mitten's herbarium, collected by Hutton and Kirk, were two (Nos. 242 and ? 282) unlocalized specimens of *Triquetrella*, which agree well with *T. filiformis* C. M., a species described from and hitherto only known, I believe, from Adelaide, South Australia. It differs from *T. papillata* in the darker, more rigid stems (if the herbarium specimens are to be trusted), and in the leaf-characters given above in the key. The papillae in *T. papillata* are often very high and branched, while here they are much lower, and single, or inconspicuously branched only.

LEPTODONTIUM Hampe.

Leptodontium interruptum (Mitt.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 399.

Syn. *Didymodon interruptus* Mitt. in Handb. N.Z. Fl., p. 421 (1867).

A fine plant, easily known by its robust habit, 5 cm. in height, its broad, acute, strongly squarrose-recurved leaves when moist, with strong yellowish nerve, opaque cells somewhat elongate but not hyaline at the base, and plane margin variously erose or denticulate towards apex. It has not been found in fruit, and I do not know of any locality besides those of the original gatherings by Kerr and Sinclair, which are, I believe, unspecified. It is also known from Amsterdam Island and Australia, where it was gathered on the Swan River by Drummond.

Certain species of *Tortula* (§ *Syntrichia*) with large recurved denticulate leaves might in absence of fruit be taken for it, but they would be recognized at once by the margin usually more or less recurved, and the lax, hyaline basal cells.

TETRACOSCINODON R. Br. ter. in Trans. N.Z. Inst., vol. 28. p. 531.

[See *Eucladium irroratum.*]

TRIDONTIUM Hook. f.

Tridontium tasmanicum Hook. f., Ic. pl. rar., ii, t. 148 (1841); Fl. N.Z., ii, 65.

Syn. *Dicranum tasmanicum* Hook. f., Handb. N.Z. Fl., p. 410. *Didymodon tasmanicus* Mitt. in Journ. Linn. Soc., iv, 70 (1859). *Dicranum rostratum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 458. *Cinclidotus australis* Dixon in Bull. Torr. Bot. Club, 42, p. 96 (1915).

This is no doubt a widely distributed plant, and one easy of recognition from the robust habit, yellow-black colour, stout capsules, large, broad, very obtuse and subcucullate leaves, densely and minutely areolate above, narrow and elongate in mid-base, with a distinct border of larger, wider cells reaching some distance up the margin; the stout nerve ceases just below the apex. It is well known in Tasmania, and I have lately received from Mr. G. Webster sterile plants which must be referred here, from Gippsland, Victoria (coll. Rev. W. Bennett); while it is also recorded by W. W. Watts from New South Wales.

The only moss likely to be confused with it is *Eucladium irroratum*. This has more than once been labelled "*T. tasmanicum* var. *angustatum*," and I had a robust form in my herbarium for some time under that name before discovering its true affinity. In the moist state, however, *E. irroratum* is readily known by its very rigid leaves with remarkably stout nerve, much narrower in their upper part than in the present plant, which in fact it does not resemble at all closely in structural details. The capsules in the *Eucladium*, while very much resembling those of *Tridontium*, are narrower and more elongate, with a much more delicate peristome. Here the teeth are very pale, not reddish, papillose all over, and each irregularly divided into 2–3 more or less filiform crura, which may anastomose or be entirely united below, but may remain free to or almost to the base.

In a recent paper in Bull. Torr. Bot. Club, 42, p. 96 (1915), I published a description with figures of a new species of *Cinclidotus* (*C. australis*) from a plant collected by Mr. D. Petrie at bottom of creeks, Kaitangata, Otago. I find, unfortunately, that this must be considered a submerged form of *Tridontium tasmanicum*. The corkscrew-like twisting of the leaves when dry—a marked feature in some of our northern aquatic species of *Cinclidotus*—is scarcely found in the terrestrial forms of *Tridontium*, while the habit and branching are quite like the quasi-pleurocarpous habit of *Cinclidotus*, but the leaf-structure, remarkable as it is, is precisely that of the present species. None of the descriptions of *Tridontium* which I have been able to consult make any reference to the peculiar marginal areolation near the base of the leaf, nor to the remarkable thickening of the leaf-margin, both of which structures are described and figured in the above article; but in examining *Tridontium* for the purposes of this paper I became aware that they are normal features in its leaves, and there is no doubt that Mr. Petrie's plant must be referred here, and the genus *Cinclidotus* expunged from the New Zealand Flora.

TORTELLA (C. M.) Limpr.

This genus was created to contain certain species of *Barbula* or *Tortula*, sometimes also included in *Trichostomum*, which may roughly be described as having the foliage of *Trichostomum* with the peristome of *Barbula*; the

European *Tortella tortuosa* (L.) Limpr. may be considered the type. They are mostly rather robust, often of a yellowish colour, with the leaves usually strongly cirrate or spirally twisted when dry, margins erect or incurved, never recurved, a usually stout nerve, the upper cells opaque and papillose, the lower elongate, rectangular or linear, most frequently hyaline, so that the leaf-base is often conspicuously white. A frequent feature is that the hyaline cells are continued higher in the leaf at the margin than near the nerve, so that the line of transition into the upper, chlorophyllose cells runs obliquely upwards and outwards.

Tortella stands, in fact, to *Trichostomum* in the same relation as *Barbula* to *Didymodon*. In the two more highly developed genera the peristome-teeth are long and spirally twisted to the *left* (viewed from within the spire), while the cells of the lid show a strong twisting in the same direction: in *Trichostomum* and *Didymodon* the shorter, often imperfect teeth are upright, or with only a faint tendency to twist to the *right;* and the rows of cells in the lid follow the direction of the teeth.

KEY TO THE SPECIES.

1.	Robust; perichaetial leaves very long, sheathing..	3. *calycina.*
	More slender; perichaetial leaves inconspicuous	.. 2
2.	Leaves very narrow, narrowly acuminate	1. *Knightii.*
	Leaves lingulate, obtuse and cucullate	2. *rubripes.*

1. **Tortella Knightii** (Mitt.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 397.

> Syn. *Tortula Knightii* Mitt. in Journ. Linn. Soc., iv (1859), p. 71; Handb. N.Z. Fl., p. 420. *Tortula caespitosa* var. H. f. & W., Fl. N.Z., ii, 70. *Barbula Knightii* Jaeg., Adumbr., i, 281. *B. nano-tortuosa* C. M. in Hedw., vol. 37, p. 131. *Trichostomum repandifolium* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 487. *Tr. contortifolium* R. Br. ter., *op. cit.*, p. 487. *Tr. avonense* R. Br. ter., *op. cit.*, p. 481. ? *Barbula Fristedtii* C. M. in Hedw., vol. 37, p. 131 (1898).

This species is readily known by the leaves, which are like those of *T. tortuosa* of Europe on a smaller scale (except that the hyaline basal cells do not reach so conspicuously higher at margin than near the nerve), with the same variability in length, degree of acumination, fragility, &c. There can hardly be any confusion with the other species. From the next it differs entirely in leaf-apex, and in the paler seta (though it becomes darker in full maturity, and, on the other hand, that of *T. rubripes* is pale above until quite ripe).

It may seem strange to refer the three species of *Trichostomum* of R. Brown to this plant, in view of the peristome, but there is no doubt that he described them from imperfect specimens; as a matter of fact there is not an operculate capsule in any of the specimens of these in his herbarium, all of them having old capsules exactly similar to overmature capsules of *T. Knightii,* with which the leaves entirely agree. *Tr. contortifolium* is a dwarf form, with shorter seta and capsule.

Brotherus states that *Barbula nano-tortuosa* C. M. is scarcely separable from *T. Knightii*, pointing out that the inflorescence is not dioicous, as the author states, but autoicous. In view of the variability of *T. Knightii* I feel no hesitation in reducing it to this species. *B. Fristedtii* C. M. is probably the same thing, but might possibly be *T. rubripes*, the "pedunculo flavo" being the only character at variance with that species, but the description is not sufficiently detailed for certainty.

The plant is widely distributed, and occurs in Tasmania and Australia.

2. **Tortella rubripes** (Mitt.) Broth., *op. et loc. cit.*

Syn. *Trichostomum rubripes* Mitt. in Handb. N.Z. Fl., p. 417 (1867).

I judge this to be a rare species; Mitten described it from specimens collected by Kerr in an unspecified locality in New Zealand; otherwise the only specimens I know are from Great Barrier Island, Hutton and Kirk, No. 151, in Mitten's herbarium.

It is very distinct, the leaves are oblong-lingulate from a wider, pale base, obtuse and cucullate at apex, with the nerve excurrent in a short mucro, the margins incurved above; the hyaline basal cells ascend very markedly higher at margins; the capsule is erect and symmetrical, not curved as in *T. Knightii*.

3. **Tortella calycina** (Schwaegr.) Dixon comb. nov.

Syn. *Barbula calycina* Schwaegr., Suppl. ii, Pt. i, p. 63 (1823). *Tortula calycina* Hook. & Grev. in Brewster Edinb. Journ., i, 291 (1824); Handb. N.Z. Fl., p. 420. *Tortula Walkeri* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 406.

I think the proper place of this species is in *Tortella*; the general habit is much like that of, *e.g.*, *T. inclinata* (Hedw.), and the leaf structure and form, especially the erect margins, point to this genus. C. Müller, in the Gen. Musc. Frond., places it under the § *Tortella* of *Barbula*.

It is a striking plant: the elongate tubular perichaetium and the inordinately long lid are marked features; the leaf, too, has a peculiar structure of its own. The chlorophyllose highly papillose upper cells pass abruptly near the base into elongate, linear, smooth, hyaline basal cells; but on either side of the stout, brown nerve there are a few rows of equally elongate but bright-golden cells, and these are marked with seriate papillae for some distance lower than they occur on the cells of the rest of the leaf-base, the papillae, in fact, frequently reaching very near to the insertion of the leaf. The back of the nerve also is covered for the greater part of its length with fine and evenly distributed papillae.

The leaves are wide, concave, often involute, variable in the acuteness of the point, but nearly always having the nerve excurrent in a longer or shorter mucro. The seta is much longer than in the other species of the genus.

It is distributed throughout both Islands, and, indeed, has a wide distribution throughout Australia, and also in Chile.

Tortula Walkeri is certainly, from Brown's specimen, this species. A plant also gathered by Mr. James Murray in the Waitakarei Hills (Auckland), and referred by me to *Trichostomum mutabile* Bruch. (*v.* Journ. Linn. Soc. (Bot.), xl, 444), also belongs here.

DIDYMODON Hedw.

As now understood this genus includes species having the general habit and foliation of *Barbula*, with margins usually recurved, never incurved, but differing in the peristome-teeth, which are short, erect, or slightly twisted to the *right*,* united below in a very short basal membrane: the cells of the lid are also erect or slightly inclined to the right (as viewed from within).

KEY TO THE SPECIES.

1. Leaves denticulate at apex, pointed 2
   Leaves entire, nerve ceasing below the obtuse apex 3

2. Leaves linear above, margin recurved to near apex .. .. 1. *rubellus.*
   Leaves widely oblong-lanceolate, margin slightly recurved only near base 2. *Binnsii.*

3. Plant minute, leaves shortly and very widely lingulate .. .. 3. *lingulatus.*
   Plant larger, leaves narrowly lingulate from a broader base .. .. 4. *calycinus.*

1. Didymodon rubellus (Hoffm.), Bry. eur., fasc. 29–30, p. 3.

> Syn. *Bryum rubellum* Hoffm., Deutschl. Fl., ii, 33 (1796). *Barbula rubella* Lindb., Musc. Scand., p. 22 (1879). *Didymodon erubescens* Mitt. in Handb. N.Z. Fl., p. 421. *Trichostomum curvithecum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 487.

I have given only a small part of the synonymy of this early-known species, which has hitherto not been recognized as a New Zealand plant. Examination of Mitten's *D. erubescens* at Kew leaves no doubt, however, of its identity with the northern species, with which it agrees in every particular. The lid is unusually long for the species, but I have specimens fully matching it from Yorkshire and Scotland. It belongs, in fact, to the form which has been described as var. *dentata*, having a rather luxuriant habit, longer lid, leaves rather more sharply toothed at point, and the recurving of margin ceasing some way below apex. The characters are, however, quantitative rather than qualitative, and it is rather difficult to define as a variety. The species has been known for some time from Tasmania, so that its recognition as a New Zealand species is not at all unexpected.

R. Brown's *Tr. curvithecum* is shown by his specimen to belong to *D. rubellus*. It is the type form, with leaf-margin recurved to apex, and with the shortly rostellate lid of that form.

The plant is readily recognized by always exhibiting some trace of rusty red in the lower part; the leaves are narrowly lingulate above (but variable in width), and somewhat reflexed from a wider amplexicaul base of linear, pellucid cells, the upper areolation dense and obscure with papillae. The nerve ceases below the apex, but the tip of the leaf is crowned with a smooth, pellucid acute apiculus, on each side of which are usually two or three more or less conspicuous denticulations. The capsule is frequently curved, narrowly cylindric, the peristome-teeth pale and short. Inflorescence synoicous or paroicous.

It appears to have been found only in the South Island at present.

2. Didymodon Binnsii (R. Br. ter.) Dixon comb. nov.

> Syn. *Trichostomum Binnsii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 486, t. 43 (1896).

I know of no other locality than that where Brown collected it—on damp rocks, Port Lyttelton Hills, in 1888; it is probably rare. Its affinity is certainly close with *D. rubellus*, but it is a quite distinct species. The leaves are much wider in the upper part, oblong-lanceolate, acute with a marked apiculus, the margin is very little recurved, sometimes scarcely at all, the denticulation of the apex very irregular, at times very indistinct, while at others the margin is irregularly and distantly erose-denticulate for some distance below the apex. The capsule and lid are similar, but the peristome is quite distinct. In *D. rubellus* it is *pale*, of sixteen *flat*, faintly papillose teeth, each marked with a median line, but hardly split; the thin articulations projecting laterally and occasionally connecting the teeth. In *D. Binnsii* it is *dark brown*, each of the sixteen teeth divided into two quite distinct perfectly *filiform*, erect, rather long crura, strongly but not very densely papillose, with prominent articulations frequently connecting them, and also projecting prominently at the back of the teeth. The teeth are usually regularly divided, but occasionally irregularly branched, and unite in a very short basal membrane, scarcely projecting above the orifice.

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* See note on p. 145.

3. **Didymodon lingulatus** (H. f. & W.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 406.

> Syn. *Trichostomum lingulatum* H. f. & W., Fl. N.Z., ii, 71; Handb. N.Z. Fl., p. 416. *Gymnostomum Knightii* Schimp. & Knight in Trans. N.Z. Inst., vol. 7, p. 354.

One of the most distinct species of Pottiaceae in its minute size, the stems consisting of a small brownish bulbil (when dry) of leaves which when moistened are somewhat spreading, very shortly and widely oblong lingulate, broadly rounded and obtuse at apex, the nerve ceasing at some distance below; the margin narrowly but very variously revolute, at times to apex, at others half-way only, and frequently scarcely at all or even quite plane. The upper cells are small, rather obscure with the cell-contents when young, but often quite clear and pellucid in older leaves; the basal rectangular and pellucid, rather thin-walled. The seta is very short, about 5 mm., the capsule minute, elliptical. Peristome pale brown, of sixteen teeth, each more or less completely divided into two rather long, filiform crura, finely and densely papillose, scarcely articulated, and uniting at base into a rather high basal membrane.

I have received it from Mr. Gray, collected in Wairarapa; it is probably widely distributed, but is no doubt easily overlooked owing to its small size.

A taller form with longer leaves and more elongate capsule and lid is separated as a variety by Hook. f. & Wilson, and may be worth maintaining when better known.

Gymnostomum Knightii Schimp. belongs here. Both Knight's plant in Herb. Hampe and R. Brown's specimens have only old capsules, but they are not actually gymnostomous, but show fragmentary traces of a peristome; these agree in every detail with capsules in similar condition of *D. lingulatus* in specimens where they are growing side by side with younger capsules having a well-developed peristome, and prove the two to be identical: the leaf-characters show no difference. Knight's plants have the leaf-margin more regularly and more fully recurved than occurs frequently in *D. lingulatus*, but this character is unusually variable in this species, even on different leaves from the same stem.

The history of Knight's plant is somewhat involved. Knight cites it as *G. Knightii* Schimp. in litt. No specimen occurs in Schimper's herbarium. There is a sheet of "*Weisia Knightii* Sch., Nova Zeelandia, 165, Knight & Hutton; mist. 1867." This, however, is by no means the plant under consideration, though quite probably intended to be referred to that by Schimper: it is the gymnostomous form of *Weisia viridula*. In Hampe's herbarium, on the other hand, there is a specimen of Knight's actual plant, probably the original, as "*Gymnostomum Knightii* n. sp., No. 47. New Zealand," the *generic* name and the *number* being in *Schimper's* hand. It would look as though Schimper sent the whole of Knight's plant to Hampe, marked "*Gymnostomum* ," for his opinion, and that the MS. name *Knightii* really originated with the latter, and was transmitted to Knight by Schimper. Hampe, it would seem, sent part of the specimen to C. Müller as "*Trichostomum Knightii*," for C. Müller (Gen. M. Fr., p. 45) writes, under *Trichostomum*, § Anacalypta, "Eine nacktmündige Art ist *Tr. Knightii* Hpe. von Neuseeland," I think undoubtedly referring to the specimen in question, as C. Müller's description would apply well enough, and there is no other *Tr. Knightii* to be found in Hampe's herbarium. It is rather curious that none of the four authors concerned in it observed the peristome.

4. **Didymodon calycinus** Dixon in Bull. Torr. Bot. Club, vol. 42, p. 95, t. 9 (1915).

A very marked species, not only in the long perichaetium, but in the leaves, which resemble those of *Weisia Weymouthii*, but are firmer and less recurved, with the margins more strongly reflexed, and the cells subquadrate, larger, 8-10 μ (in *W. Weymouthii* irregularly rounded, 6-8 μ). The peristome is dark brown, the sixteen teeth divided completely into two filiform, scarcely articulate, minutely papillose crura, and united at base into a well-developed closely and strongly articulate basal membrane.

The original locality, Mount Bruce, Wairarapa (coll. W. Gray), is the only known station.

EXCLUDED SPECIES.

D. papillatus H. f. & W. = *Triquetrella*.
D. interruptus Mitt. = *Leptodontium*.

BARBULA Hedw.

Distinguished from *Tortella* by the leaf-margin usually reflexed, and by a habit and leaf-structure usually easily recognizable but difficult to define: from *Didymodon* and the remaining genera of Trichostomeae by the entire leaves and usually long, red, twisted peristome: from *Tortula* by the usually smaller capsules, the narrower, often linear-lanceolate leaves with small upper cells, and generally smaller and narrower basal ones.

KEY TO THE SPECIES.

1. Leaf-margin strongly revolute .. .. 2. *torquata*.
   Leaf-margin plane or slightly recurved 2
2. Leaves narrow-linear-lanceolate, narrow at points, basal cells elongate, thin-walled .. .. 1. *australasiae*
   Leaves rather widely oblong-lanceolate, obtusely pointed, basal cells little differentiated .. .. 3. *rostrata*.

1. **Barbula australasiae** (Hook. & Grev.) Brid., Bryol. Univ., i. 828 (1826).

Syn. *Tortula australasiae* Hook. & Grev. in Brewster Edinb. Journ., i, 301 (1824); Fl. N.Z., ii, 70; Handb. N.Z. Fl., p. 419. *Trichostomum australasiae* Jaeg., Adumbr., i, 295. *Barbula rufiseta* Tayl. in Lond. Journ. Bot., v (1846), p. 51. *Tortula incurvidens* Stirt. in Proc. Nat. Hist. Soc. of Glasgow, ii, 187 (1876). *Tortula fuscescens* H. f. & W., Fl. N.Z., ii, 73. *Trichostomum Cockaynii* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 486, *p.p.* *Trich. gracile* R. Br. ter., *op. et loc. cit.*, p.p. ? *Trich. mokonuiense* R. Br. ter., *op. cit.*, vol. 35, p. 332.

A variable plant, and hence the source of much of the above synonymy. The peristome especially varies in length, and in its shorter forms quite explains the reference to the genus *Trichostomum* by R. Brown of the above plants; it is, indeed, placed in that genus by Jaeger. It is usually an abundant fruiter, and this, with the short red peristome only slightly twisted or (when moist) quite erect, will generally lead to its ready identification. The leaves are spreading or somewhat recurved, the margin usually somewhat reflexed but at times plane, the apex subobtuse or bluntly pointed, the nerve strong below but rather thin and indistinct above, vanishing below the apex.

Tortula incurvidens Stirton, of which I have examined the type in his herbarium, is simply one of the ordinary, shortly peristomate forms of this species.

The South American plant from Chile, united by Mitten with this, has been separated on slight grounds of difference under the name of *B. Poeppigiana* C. M.; but in view of the evident variability of *B. australasiae*, together with its wide distribution, I am inclined to think the two will have to be reunited.

B. australasiae is a common moss in New Zealand.

2. **Barbula torquata** Tayl. in Lond. Journ. Bot., v (1846), p. 50; Fl. N.Z., ii, 70.

Syn. *Tortula torquata* Mitt. in Journ. Linn. Soc., iv, 70 (1859); Handb. N.Z. Fl., p. 419. *Tortula crispifolia* Mitt. in Handb. N.Z. Fl., p. 419. *Tortula Bellii* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 405.

In spite of some considerable variation in size and leaf-characters this is not a difficult plant to identify from the bright yellowish-green tufts, reddish-brown below, and the leaves with margins strongly recurved from base almost or quite to apex, strongly spirally twisted when dry (much as in the European *B. unguiculata*) in the denser forms so that the stems are terete, but in the laxer and longer leaved ones with the points usually sticking out—"horride spiraliter torta." The leaves are wider than in the last and more pointed, the nerve is stout and yellowish, becoming indistinct at the opaque apex, so that it is not easy to see where the lamina ceases and the nerve begins, but it appears to be usually percurrent (though no doubt sometimes scarcely reaching apex), and is certainly at times distinctly excurrent in a short robust point. The upper cells are incrassate, variously rounded or quadrate, rather distinct, scarcely papillose; while all the basal are small, very narrowly rectangular or linear, pellucid, often yellowish, a few rows at margin often remaining quadrate or subquadrate quite to the base. The capsule is rather long, and nearly always either curved or asymmetrical, the peristome long and much twisted, rather pale, from a well-developed but not very long tubular basal membrane.

I have examined the type of *T. crispifolia* Mitt. at Kew, and am convinced that it is only one of the longer-leaved forms of *B. torquata*; the nerve is more distinctly excurrent than usual, but in all other characters it is identical with the more robust states of this species.

Tortula Bellii R. Br. ter. is also this plant. R. Brown, it may be recalled (Trans. N.Z. Inst., vol. 30, p. 400), states that he has been unable to identify *T. torquata*, *T. crispifolia*, and *T. australasiae*.

I have it from one or two localities in the South Island, but it is probably more frequent in the North; it is found also in Tasmania and Australia.

3. **Barbula rostrata** (R. Br. ter.) Dixon comb. nov.

Syn. *Trichostomum rostratum* R. Br. ter. in Trans. N.Z. Inst., vol. 29, p. 485.

This species is represented by a single tuft without fruit in Brown's herbarium, and I have not seen it elsewhere. In colour and habit it resembles *Tortula phaea*. The leaves are erect and slightly incurved when dry, but otherwise little altered; they are 2–2·5 mm. long, widely oblong-lanceolate, scarcely acuminate, broad at the points; the apex is frequently obtuse, but I am not clear whether this is not always due to erosion; the upper, younger leaves being almost always subacute, with somewhat incurved points; the nerve, which is very prominent at back, is lost in or just below the apex; the margins here and there narrowly recurved or reflexed, or subplane; the upper cells 7–10 μ in diameter, angular, more or less incrassate, rather opaque. The chief feature of the plant is the basal areolation, which is little differentiated from the upper, the cells being shortly rectangular only, and all incrassate, scarcely pellucid, the marginal in several rows often quadrate, only a few next the nerve at most being elongate-rectangular (3–4 × 1).

According to R. Brown the perichaetial leaves are erect, linear-lanceolate, and acute; the seta $\frac{3}{8}$ in. long, the capsule cylindric, with a lid about as long. The peristome is not described or figured, and Brown writes of the species "(? *Tortula*)," so that there is no direct indication that the peristome is Trichostomoid, and I do not feel much hesitation in placing it in the present genus; the upper cells and areolation generally seem to indicate that it is not a *Tortula*, while the length of the lid is very strong presumptive evidence of a long, Barbuloid peristome.

The habitat is described by Brown as "crevices of limestone rocks, Broken River, West Coast Road."

II. CINCLIDOTEAE.

[*Cinclidotus australis* Dixon = *Tridontium tasmanicum* (*v. supra*). The subfamily Cinclidoteae is therefore not represented in New Zealand.]

III. POTTIEAE.

ACAULON C. M.

Cleistocarpous, annual, phascoid mosses, almost stemless; the lower stem-leaves minute, three or four upper much larger, inflated concave sheathing one another and almost or quite enclosing the small subspherical almost sessile fruit. Calyptra very minute.

Acaulon apiculatum (H. f. & W.) Jaeg. M. Cleist., p. 20 (1869).

> Syn. *Phascum apiculatum* H. f. & W., Fl. N.Z., ii. 59 (1855); Handb. N.Z. Fl., p. 402. *Sphaerangium apiculatum* Par., Ind., p. 1172 (1892).

This minute but distinct little moss is probably not uncommon, but may have been overlooked. It exists in R. Brown's herbarium from Christchurch, and I have it from the Lyttelton Hills (coll. Beckett), and from Otago (coll. Petrie). The original locality was Hawke's Bay, North Island. Also found in Tasmania.

CALYPTOPOGON Mitt.

Calyptopogon mnioides (Schwaegr.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 419 (1902).

> Syn. *Barbula mnioides* Schwaegr., Sp. Musc. Frond., Suppl. iv, p. 310 (1842). *Tortula mnioides* Mont. in Gay, Fl. Chile, vii, 150; Fl. N.Z., ii, 71; Handb. N.Z. Fl., p. 420. *Streptopogon mnioides* Mitt. in Journ. Linn. Soc., iv, 72. *S. Hookeri* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 410.

E. S. Salmon has gone so fully into the history and synonymy of this fine plant in Journ. Bot., 1903, pp. 1, 45, that there is no need to go further into it here. He shows clearly that *S. Hookeri* must be reduced to the main species, and, in fact, that *Calyptopogon* is a monotypic genus, ranging over a good part of South America and the greater part of Australasia.

When in fruit it is recognized at once by the short seta and very long sheathing perichaetium. When sterile (which is usually the case) it is easily known by its leaves with their stout white border of narrow cells (*Tortula Petriei* Broth. has a similar border, but the resemblance ends here), undulate and crinkled at margin when dry. It is also principally a corticolous moss, often growing mixed with *Orthotricha*; varying in size from a centimetre or so to 4 or 5 centimetres. It rarely fruits, but five fruiting specimens were sent to Kew by R. Brown, and I have received others from Mr. D. Petrie and Mr. W. Gray.

HENNEDIELLA Par., Ind., p. 557 (1894).

This genus was established as *Hennedia* by R. Brown ter. in Trans. N.Z. Inst., vol. 25, p. 285, for three species of mosses, but the name had already been preoccupied for a genus of Algae.

They resemble some species of *Pottia* in the leaf, which has a denticulate apex, and a distinct pale or brown border of elongate or smooth cells, a very short seta so that the capsule is often almost or quite hidden; the special character of the genus lies in the very large campanulate calyptra descending to the base of the capsule; the peristome is wanting.

The calyptra is truly campanulate until near maturity, but as the capsule ripens it (sometimes at least) splits the calyptra up one side, and it becomes more or less cucullate, still, however, covering the whole or the greater part of the capsule.

KEY TO THE SPECIES.

1.	Seta about equal to capsule in length	1. *macrophylla.*
	Seta considerably longer than capsule	2
2.	Seta equal to or shorter than the leaves..	2. *intermedia.*
	Seta longer than the leaves	3. *microphylla.*

1. **Hennediella macrophylla** (R. Br. ter.) Par., Ind., p. 557 (1895).

Syn. *Hennedia macrophylla* R. Br. ter. in Trans. N.Z. Inst., vol. 25, p. 286 (1893). *Beckettia bruchioides* C. M. in Hedw., vol. 37, p. 77 (1898). *Hennediella bruchioides* Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 420. *Pottia marginata* Beck. in Trans. N.Z. Inst., vol. 25, p. 290 (*non P. marginata* C. M. in Hedw., vol. 37, p. 132).

H. macrophylla differs from the two following species as I understand it, in the larger, wider, less acuminate leaves, with very distinct brown border of elongate incrassate cells, the large, elongate capsule, 2·5–3 mm. without lid, on a seta of about the same length only, so that the capsule is only partially emergent, rarely fully exserted above the leaves; it varies in this respect considerably, and I have not seen any specimens with the capsule actually immersed. R. Brown, it is true, describes it as immersed, but neither description nor figure gives any indication of the length of the seta or any view of the plant as a whole; and I am inclined to think the term is used a little loosely, in the sense of emergent—*i.e.*, not fully exserted.

The history of *Beckettia bruchioides* is rather peculiar. T. W. N. Beckett sent, in 1892, a gathering of W. Bell's (Pine Hill, Dunedin, Jan., 1888, No. 502) to C. Müller, who named it *Pottia marginata* sp. nov. This he (C. Müller) described in *Hedwigia*, vol. 37, p. 132. In the same publication (p. 77) he described the new genus *Beckettia*, founding it upon a plant of Beckett's, "Lyttelton Hills, prope Christchurch, in solo argillaceo, Octobri, 1887: T. W. Naylor Beckett legit inter *Pottiam marginatam*, misit 1892."

Fortunately R. Brown, though he has preserved no specimens of his own gatherings of *Hennediella* in the Canterbury Museum, has a sheet of Beckett's containing both the above-mentioned collections, together with a second gathering of his own ("Niggerheads, Wairarapa Stream, Fendalton, July, 1889"), and another of Bell's ("Clay banks, Pine Hill, Dunedin, Oct., 1887")—also numbered 502. All these are labelled in Beckett's hand "*Pottia marginata* Beckett sp. nova," and they enable one to clear up a good many obscure points.

Beckett, on receiving C. Müller's determination, published *Pottia marginata* sp. nov. in a paper read before the Philosophical Society of Canterbury, 5th October, 1892, and issued in vol. 25 of the Trans. N.Z. Inst. in 1893, p. 290, citing for it the localities enumerated above, and one or two others. An examination of the description and figures, however, and still more a study of his specimens, shows that the plant he had in view was not the *Pottia marginata* of C. Müller, but the other plant, mixed with it, which C. Müller afterwards described as *Beckettia bruchioides*; or possibly he had both plants under his eyes without distinguishing them, for the two closely resemble one another, and the separating characters are irritatingly elusive. In fact, there can be no doubt that the plant which C. Müller describes as *Pottia marginata* is also a *Hennediella*, and agrees with R. Brown's *H. microphylla*. The description given by C. Müller fits this in every way except in one respect—to be sure, a vital one—viz., that he describes the calyptra as "*parva*." If this were the case the plant could not, of course, well be considered a *Hennediella*, and I must admit that the question is perplexing. However, Beckett's specimens "*leg.* Bell, Jan., 1888," the identical gathering from which C. Müller described his *P. marginata*, contains two and only two plants—one a more robust plant with long, large, scarcely exserted capsules quite "bruchioid" in appearance, corresponding to *Beckettia bruchioides*, the other a much smaller minute plant, with considerably smaller, quite exserted capsules; this is certainly *P. marginata* C. M., and is equally certainly a *Hennediella*, agreeing, as mentioned above, with *H. microphylla* (R. Br. ter.). Now, most of the capsules of this are deoperculate, but two have the calyptra remaining *in situ*, and show clearly the calyptra of *Hennediella*; and I make no doubt that either C. Müller was deceived by an unattached calyptra of some other moss, or more probably that he had the actual calyptra before him but not *in situ*, and therefore not showing that it covered the whole or the greater part of the capsule; in which case the description as "*parva*" would not be altogether inappropriate. The calyptra, moreover, is certainly smaller and much less conspicuous than in the other plant mixed with it.

Brotherus separates *H. bruchioides* C. M. from the remaining species as having the "lid not differentiated." C. Müller having described his Beckettia as belonging to the Phascaceae, with "Capsula phascacea minuta," and as "primo visu cum Bruchia facile commutanda." Now, this is perfectly true of the appearance of the larger plant (*H. macrophylla*), especially in the specimen sent to C. Müller of Bell's collecting; but microscopical examination shows that the lid is perfectly differentiated and separable, while other, deoperculate specimens (none of which, no doubt, reached C. Müller) show in a rather remarkable manner that, minute as the lid appears while the capsule is immature, by the time the fruit is ripened and the lid separates it is quite wide-mouthed, and ripe deoperculate capsules agree in shape exactly with those of the smaller species (*P. marginata* C. M. = *H. microphylla*), and are, in fact, Pottioid in appearance. The capsule is quite gymnostomous and the spores 16–22 μ in diameter.

Beckett, as I have mentioned, gives his own name to the binomial in his herbarium, but published the name as "*Pottia marginata* n. sp." only, while C. Müller ignores Beckett's previous description altogether. The proper attribution of all the species thus published by Beckett and determined by C. Müller appears to me to be "C. M. and Beckett." In the present case, however, both names must sink to the synonymy of *Hennediella*, R. Brown having published his descriptions in a paper which, curiously enough, immediately precedes Beckett's paper in the same volume, only four pages separating them.

The series of plants mounted by Beckett shows, as I have mentioned, a perplexing similarity between the two plants associated together, and I should not be at all surprised if it ultimately transpires that all forms of *Hennediella* belong to one variable species. I have found no structural differences, and the length of seta and degree of exsertion of the capsule is most perplexingly variable. None of Beckett's plants have the capsule immersed, though in some the leaves attain to the base of the capsule. It may be argued that these should be referred to Brown's *H. intermedia*, and that his *H. macrophylla* with immersed capsules is not represented there at all. But Beckett's larger plant has the leaf-form and size of

H. macrophylla, and if these can be associated with fruit of *intermedia* there is absolutely nothing to separate the two but the slightly and very inconstantly longer seta of *H. intermedia.*

I have therefore retained Brown's original three species, but with some considerable doubt as to their validity; and I have based the difference between *H. macrophylla* and the others, in the key, not on the actual length of the seta, or the degree of exsertion of the capsule—which obviously depends somewhat on the length of the admittedly variable leaves—but on the relative lengths of capsule and seta; in Beckett's larger plant the seta is only equal to the capsule-length, or even shorter, while in the other two species the capsule is smaller, and decidedly shorter than the seta.

2. **Hennediella intermedia** (R. Br. ter.) Par., *op. et loc. cit.*

Syn. *Hennedia intermedia* R. Br. ter., *op. et loc. cit.*

Capsule decidedly shorter than the seta, which, however, is scarcely longer than the leaves. Leaves longer and narrower than in the previous species.

R. Brown admits the difficulty of separating this and the next species from one another, but, as he states that he has observed the two for several years and never found them intermingled or observed intermediate forms, I cannot feel justified—not having been able to see the present species—in overriding his judgment. I would, however, point out that there is (apart from the degree of exsertion of the capsule) in his description of the two absolutely nothing to suggest any difference beyond the fact that *H. intermedia* is described as "dark green" and *H. microphylla* as "pale green."

A plant in Mr. Petrie's collection, from Waitahuna, Tuapeka County, may possibly belong here; it is, however, not mature, and there is some doubt as to whether the setae have attained their full length; otherwise the capsule is not fully exserted, and the leaf-areolation presents some slight difference from that of *H. microphylla*, which may or may not be a specific character.

3. **Hennediella microphylla** (R. Br. ter.) Par., *op. et loc. cit.*

Syn. *Hennedia microphylla* R. Br. ter., *op. et loc. cit.* *Pottia marginata* C. M. in Hedw., xxxvii, 132. *Pottia grata* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 293. ? *Pottia austro-georgica* Card. Not. prélim. in Bull. Herb. Boiss., 2me sér., vi, p. 5.

This species, and probably the last, appear to differ from *H. macrophylla* —apart from sporophytic characters—in having a narrower and paler border of marginal cells, less elongated at any rate in the upper part of the leaf, and differentiated from the median cells less by form than by being empty and smooth, or nearly so, as compared with the papillose, somewhat opaque cells of the middle of the leaf: this species is figured by Brotherus, *op. cit.*, fig. 274; but it fails to give a good idea of the strong, highly differentiated border characteristic of *H. macrophylla*, and present, at least in the lower part of the leaf, in the other species.

R. Brown in Trans. N.Z. Inst., vol. 26, p. 289, has some strictures on Beckett's methods and on his description of *P. marginata*. That Beckett had confused two plants is true, as I have pointed out above; but it is not at all clear from the passage referred to where exactly Brown's difference with Beckett lies; while his main contention—viz., that the plant which he proceeds to describe in that paper as *Pottia grata* is different from *H. microphylla*—cannot, I think, be maintained. Fortunately, among the few existing specimens of *Pottia* in his herbarium there is a specimen of his *P. grata*, which only bears out in a very slight degree the characters he attributes to it in the paper in question. He says that the cell-tissue of *H. microphylla* is at least double of that of the *Pottia*; but I can detect no difference at all. The lid of the *Pottia* he describes as long and oblique, while that of the *Hennediella* is short, stout, and conic. This is certainly usually the case, but the lid varies a good deal, in *H. macrophylla* at least, and probably therefore in *H. microphylla*. The difference in the calyptra, which he describes as cucullate in the *Pottia* and only covering half the capsule, is but partially borne out by the specimens. In the younger capsules of the *Pottia grata* they enclose the whole capsule and embrace it tightly at the base; in the more mature ones, it is true, they are often split on one side and do not reach much below the middle. This is, however, simply due to the fact that the specimen is a very robust one, and the capsules larger than usual. Now, as the calyptra is incapable of growth after separation from the vaginula, it follows that when a capsule becomes unusually developed in size the calyptra, which would normally enclose the capsule, tightly fitting it like a glove, and might remain intact below, cannot do so under the unusual conditions, but tends (also like a glove) to split—in this case being both lifted upwards and split laterally. This variation is shown quite well in Bell's Pine Hill plant (January, 1888) I look upon *P. grata* as certainly a robust form of *H. microphylla*.

It cannot, however, be denied that this form and one or two other plants form a distinct bridge, through *P. Heimii*, between *Pottia* and *Hennediella*. The full *Hennediella* character of calyptra is somewhat weakened by Brown's *Pottia grata*, while from the other side *P. Heimii*, with its toothed leaves and frequently differentiated marginal cells, shows a distinct affinity with *Hennediella*. This is further emphasized by two Antarctic plants, *Pottia austro-georgica* Card. and *P. fusco-mucronata* C. M. From the full and careful description and figures given by Cardot of his *P. austro-georgica* there can be no doubt that it is extremely close to *Hennediella*—the short seta, toothed and bordered leaves, and calyptra "fissa, apice laevis, totam capsulam obtegens" showing a close relationship to that genus; the lid is long-beaked (equalling the capsule), which distinguishes it to some extent; while, on the other hand, it is not adherent to the columella, which separates it from *P. Heimii*. It appears to me on the whole extremely likely that it is a *Hennediella*, probably inseparable from *H. microphylla*.

P. fusco-mucronata C. M., however, is described as having the lid adherent to the columella, and is therefore, I think, undoubtedly close to *P. Heimii*, while, on the other hand, the very short seta, and the calyptra "totam fere thecam obtegente," indicate a near relationship to *P. austro-georgica* and *Hennediella*.

Since the above was written I see that Warnstorf (Pottia-Studien, in Hedwig., lviii. p. 93) has expressed the opinion that *P. fusco-mucronata* is scarcely separable from *P. Heimii*.

POTTIA Ebrh.

The genus *Pottia* stands in somewhat the same relation to *Tortula* as *Weisia* to the higher genera of Trichostomeae. The plants are usually annual, small and short, with very short stems, short seta, and small and short, oval, rarely narrowly elliptical and never longly cylindric capsules;

the peristome is frequently wanting, and when present short, of often fragmentary, lanceolate, not filiform teeth; the spores usually large. The leaves are generally more or less spathulate, the upper cells rather lax, but often obscured by papillae.

Most unfortunately, of the fifteen new species described by R. Brown under *Pottia* and *Anacalypta*, only three exist in his herbarium. The following arrangement is based partly upon a careful study of his description and figures, partly upon material from other sources which I have been able to identify, with a fair degree of certainty, with one or other of his species; and although the elaboration of an arrangement under such circumstances is rather like making bricks without straw, I believe I have been able to bring the New Zealand species into a fairly clear order and within more restricted limits without doing great violence to R. Brown's work, even if I should have unwittingly made an erroneous reduction of his species in one case or another.*

KEY TO THE SPECIES

A. Subgenus *Schizophascum* C. M. (*Dendia* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 411).
    Capsule without a differentiated lid, splitting horizontally about the middle .. 1. *maritima*.
B. Subgenus *Pottia* sensu stricto Broth. Lid differentiated, separating.
    I. Peristome present. Leaves minute, lid shortly conical .. 2. *zealandiae*.
    II. Peristome wanting; lid beaked.
        A. Margin recurved .. .. 5. *Alfredii*.
        B. Margin plane.
            a. Leaf apex toothed.
                * Seta $\frac{1}{4}$–$\frac{1}{2}$ in. .. .. 3. *Heimii*.
                ** Seta $\frac{1}{8}$ in. .. .. 4. *serrata*.
            b. Leaves entire.
                * Nerve excurrent .. .. 8. *Stevensii*.
                ** Nerve not excurrent.
                    † Minute, all leaves small, subspathulate, subplane; cells large .. .. 6. *areolata*.
                    †† Upper leaves long, erect, concave .. 7. *longifolia*.

1. Pottia maritima (R. Br. ter.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 423.

Syn. *Dendia maritima* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 411 (1898).

This curious and interesting moss is well recognized not only by the peculiar fruiting character, but by the rather large, erect, very wide and very concave, almost convolute pellucid leaves, with subobtuse apex, apiculate with the excurrent nerve.

The peculiarity of the capsule, from which the lid does not separate, but which splits across a median zone—usually, I believe, along the transverse walls of adjacent cells—at first sight quite justifies R. Brown's creation of a new genus for it, but closer examination, I believe, will convince that Brotherus is more correct in uniting it with *Pottia*. In fact, there is some reason for thinking the suggestion a plausible one made to me in a letter from E. S. Salmon, who had carefully studied material sent him by Brown, that the character may not only not be a generic one, but a pathological one simply, due to the more or less complete immersion of the capsules from time to time in sea-water. In support of this there are the following considerations: Up to a late stage in its growth the capsule developes in a normal Pottioid manner, and until dehiscence takes place there is nothing to indicate any abnormal condition. Now, in truly cleistocarpous mosses the capsule is as often as not apiculate, but the quasi-operculum is rarely longly-beaked as it is in this case. Moreover, all the capsules I have examined at the stage of dehiscence bear all the appearance of having the exthecium in an unhealthy, not to say thoroughly rotten condition: and it is evident that the particular zone chosen for dehiscence is only a fortuitous one, not morphologically differentiated, from the fact that the capsule-wall continues to break away farther and farther in a more or less horizontal outline, so that overmature tufts show the bulk of the capsules nearly entirely disappeared, only a small truncate portion of each left remaining on the seta, like miniature champagne-glasses.

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* Since the above was in type I have received from Mr. G. Brown specimens of nearly all Brown's types of *Pottia*. These have entirely confirmed the conclusions at which I had already arrived, and it is very satisfactory to be able to base them not on conjecture but on actual examination of the plants.—H. N. D.

On the other hand, if the fruit were normally stegocarpous one would certainly expect the mature but intact capsule to show at the base of the lid a circle of more or less differentiated cells marking the line where the lid should normally separate, but in the examples I have examined there is scarcely a trace of this. The exact morphological value of the structure will probably only be settled by careful examination in the field. A knowledge of the exact conditions under which the two allied plants *P. disrumpens* (C. M.) and *P. splachnoides* (Hornsch.) were found would also assist in elucidating the problem.

The spores measure 30-36 μ. The superficial cells are often markedly turgid and pellucid.

Roth (Aussereuropaïsch. Laubm., i, 217) gives under the synonymy of this species "*Phascum* C. M. in Hedw., 1898, p. 235." The reference, however, is a false one, and I am unable to explain it.

I do not know that *P. maritima* has been found elsewhere since Brown collected it in Heathcote Estuary, near Christchurch, in 1896, and Searell in the same year.

2. **Pottia zealandiae** (R. Br. ter.) Par., Ind. Suppl., i, p. 284.

Syn. *Anacalypta zealandiae* R. Br. ter. in Trans. N.Z Inst., vol. 30, p. 413 (1898).

A minute species, distinct from the other New Zealand species hitherto recognized in having a rudimentary, often fragmentary peristome, consisting principally of a short, pale, papillose basal membrane, as also in the very shortly conical lid. The leaves are minute, widely oval, shortly apiculate, with the margin narrowly recurved. It is closely allied to the European *P. minutula* Fürnr. and its allies, scarcely indeed separable from *P. commutata* Limpr. in most characters, but in one marked particular it is much nearer to *P. Starkeana* C. M.—viz., the spores, which are from 16–22 μ in size, coarsely tuberculate like thin "bags filled with apples," as Venturi has remarked.

Brown collected it on sandy soil in the Christchurch Domain; I have not seen it except in his herbarium.

3. **Pottia Heimii** (Hedw.), Bry. eur., fasc. 18–20, p. 12 (1843).

Syn. *Gymnostomum Heimii* Hedw., Descr., i, 80 (1787). *Pottia Douglasii* R. Br. ter. in Trans. N.Z. Inst., vol. 26, p. 293.

The only hesitation I should have felt about identifying R. Brown's *P. Douglasii*, which exists in his herbarium, with the plant of the Northern

Hemisphere would be from the point of view of its geographical distribution. Paris gives New Zealand (I am not sure on what authority), but all the other localities, ranging over practically all Europe, and North America from the Arctic zone to California, and extending into Asia, are from the Northern Hemisphere. Cardot, however, has identified it from Chile, Patagonia, and the Falkland Islands, and mentions it from New Zealand (whether solely on the authority of Paris or not I do not know), and any objection from the geographical standpoint is therefore overcome. Brown's specimens at first sight differ from *P. Heimii* in one rather marked respect, viz., in having the seta not twisted. This, however, is solely due to the tuft having been mounted in the moist condition, and the capsules glued down to the sheet, thus preventing the torsion of the seta on drying. On removal and again drying they twist strongly to the left as usual. This is also the case with specimens labelled "*P. Douglasii* R. Br., moist ground, Christchurch, N.Z., coll. T. G. Wright, 1 July, 1894, ex herb. Beckett," sent me by Rev. C. H. Binstead.

It is found in marshy ground, almost always near the sea, and is readily known by the leaves sharply denticulate or dentate near the apex, acuminate with a cuspidate point formed by the excurrent nerve, by the long seta and rather large, pachydermatous capsule, the lid of which after rupture remains for some time attached to the columella, finally falling off with it.

The spores are large, 25–35 μ, normally finely punctulate, but in the New Zealand plant occasionally with rather coarse, irregularly scattered tuberculate papillae. This I have also found in the Tasmanian plant mentioned below.

The only plants which could be confused with it are the following one, recognizable at once by the very short seta, and species of *Hennediella*, which are known by the calyptra and small lid, as well as by the distinctly bordered leaves. The marginal cells in one or two rows, in *P. Heimii*, are occasionally slightly differentiated from the inner, but not so as to form a conspicuous border.

P. Heimii is very variable in size, &c., and the synonymy, which I have not thought it necessary to give, is a very long one. I have a specimen from Kakanui, Otago (coll. D. Petrie, Sept., 1892, No. 604), sent me by Rev. C. H. Binstead, labelled "*Pottia aristata* Broth.* n. sp.," which also, I feel certain, is to be referred to *P. Heimii*. The species may possibly be found to be widely distributed on marshy ground near the sea-coast, but at present is only known from a limited area on the east side of the South Island. I have it, however, also from Tasmania, *coll.* Weymouth.

4. Pottia serrata R. Br. ter., *op. cit.*, vol. 26, p. 291, tab. 32 (1894).

No specimens survive in Brown's herbarium, and I have nothing to go upon but his description and figures, but I think in all probability it may be a good species, agreeing with the last, and distinct from all the remaining, in the toothed apex of the leaf. Considering the variability of *P. Heimii*, it may naturally be doubted whether it is not merely a form of that, but certain features seem to me to point to a real difference. These are principally (*a*) the very short seta, "about $\frac{1}{4}$ in.," while in *Pottia Heimii* it is rarely so short, though I have a specimen from Scotland with the setae all just that length; (*b*) the apparently free operculum, judging by the figure, and the absence of any note by Brown, who describes in *P. Douglasii* the adherence of the columella to the lid ; and (c) the locality (damp banks, Port Lyttelton Hills), which does not quite fit in with what one would expect from *P. Heimii*.

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* The writing is not clear: it might be "Beck."

5. Pottia Alfredii R. Br. ter., *op. cit.*, p. 290.

No specimens exist. It should be distinct from all the other gymnostomous species with entire leaves in having the margin recurved to near apex. I have, however, a suspicion that it may really be a peristomate species and be identical with *P. zealandiae* (R. Br. ter.). No lid or calyptra was found, implying that the capsule was past maturity, and this might well account for a fragmentary peristome having disappeared. The figures and the description, otherwise, would quite bear out this interpretation.

The habitat given is "on damp banks, Port Lyttelton Hills ; coll. by R. Brown."

6. Pottia areolata (Knight) Dixon comb. nov.

Syn. *Gymnostomum areolatum* Knight in Trans. N.Z. Inst., vol. 7, p. 355 (1874). *Pottia Whittonii* R. Br. ter., *op. cit.*, vol. 35, p. 329 (1902).

I have not been able to see Knight's plant, but from the description and figures I have no doubt of its identity, and it would appear to be distinct from any other described species in the minute size, subspathulate leaves with plane margins, rather large upper cells, and nerve ceasing just below apex. The minute size, the spreading leaves, and probably the smaller spores (18–22 μ) distinguish the species from *P. longifolia*.

P. Whittonii was gathered by Brown at Oamaru ; Knight gives no locality whatever. I have no doubt at all that the Oamaru plant is the same as that described by Knight.

7. Pottia longifolia R. Br. ter., *op. cit.*, p. 292.

Syn. *P. Leonardi* R. Br. ter., *op. cit.*, p. 293. *P. assimilis* R. Br. ter., *op. cit.*, p. 294. *P. Bickertonii* R. Br. ter., *op. cit.*, p. 292.

P. longifolia is marked by the rather strikingly long, erect, very concave upper leaves, notably distinct from the shorter, wider, lower ones, the rather large size, and the lax, often pellucid areolation.

The identification of the other species included in the synonymy might be doubtful were it not for the fact, at first rather perplexing, but in the event somewhat satisfactory, that specimens of this species coll. D. Petrie, Tuapeka County, small as they are in quantity, show a very great range of variation, quite sufficient, I think, to include all the plants in question. I had no doubt, in fact, at first that two species were included, one agreeing in measurements with Brown's *P. longifolia* (seta $\frac{1}{8}$ in., capsule elliptical, lid with a long rather robust oblique beak), and showing the long, erect upper leaves markedly ; the other much smaller, with a much shorter seta, short widely oval capsule, much shorter and often erect beak to the lid, and with few or none of the erect, differentiated upper leaves. A closer examination showed, however, intermediate forms, and proved that all belonged to one and the same species. On this ground I have felt quite justified in reducing nearly all the species described by Brown, having plane-margined leaves and non-excurrent nerve, to this species.

The leaves are rather soft and flaccid, mostly very concave, cells rather large, thin-walled and chlorophyllose, apex incurved, shortly acute or apiculate, nerve becoming indistinct and vanishing in the point. The spores are 22–27 μ in diameter.

All the plants described by Brown appear to have been collected in the near neighbourhood of Christchurch.

8. Pottia Stevensii R. Br. ter., *op. cit.*, p. 291 (1894).

Syn. *P. Wrightii* R. Br. ter., *op. cit.*, p. 261. *P. macrocarpa* R. Br. ter., *op. cit.*, p. 292. *P. Brownii* Par., Ind., p. 1020. *P. acaulis* R. Br. ter., *op. cit.*, p. 290. *Trichostomum ligulatum* R. Br. ter. *op. cit.*, vol. 29, p. 485 (1896). *Pottia reticulata* C. M. in Hedw., xxxvii. 132 (1898).

Distinct from the remaining species of *Eu-Pottia* with plane entire margins in having the nerve excurrent in a mucro or cuspidate point. *P. macrocarpa* and *P. Whittonii* are only forms of *P. Stevensii*, differing very slightly at most in the length of the seta and the size of the capsule. I should judge also from the rather featureless description of *P. reticulata* C. M. that it refers to the same moss; and this is entirely confirmed by the fuller description and figures given by Warnstorf (Hedwig., lviii. 123).

Paris changed the name of *P. macrocarpa* to *P. Brownii* owing to the existence of *P. macrocarpa* Schimp.

I have no hesitation further in identifying with it the plant described by Brown later as *Trichostomum ligulatum*, which is found in his herbarium (as *T. ligulatifolium*). This quite agrees with *P. Stevensii*.

It is a species very closely resembling the European *P. truncatula*, but with a more elliptic, narrower-mouthed capsule, in this respect being more like *P. intermedia* Fürnr., but differing in the quite plane margin of the leaf.

T. ligulatum was collected on Mount Torlesse, *P. reticulata* near Dunedin by W. Bell, the remaining plants near Christchurch. The species is probably a fairly common one, but disappears quickly like our allied European species

EXCLUDED SPECIES.

Anacalypta Stevensii R. Br. ter. (*op. cit.*, vol. 30, p. 113, 1898) is *Fissidens Taylori* C. M. The specimens in Brown's herbarium are quite conclusive; they are unmixed, and in fair quantity. There are none of the sterile stems among them, the capsules are mostly old with the peristome fragmentary, and the minute vaginant leaves with very little of the *Fissidens* character apparent have misled Brown entirely. Brown himself, it will be noted, was perplexed over the bifid peristome teeth.

CROSSIDIUM Jur.

Crossidium was separated from *Barbula* and *Tortula* by Juratzka for a small number of very striking mosses, mostly habitants of warm sunny rocks and walls, known at once by the nerve bearing on its upper surface a dense mass of jointed filaments, which cover a great part of the upper lamina, and terminating in a long hyaline arista. In the fruiting characters they resemble *Tortula*.

Crossidium Geheebii (Broth.) Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 426.

Syn. *Tortula Geheebii* Broth. in Oefv. af Finska Vet.-Soc. Förh., xlii, 114 (1902). *T. chloronotos* H. f. & W., Fl. N.Z., ii, 69; Handb. N.Z. Fl., p. 418 (*nec T. chloronotos* Brid.).

C. Geheebii is very closely allied to the northern *C. chloronotos*, but Brotherus points out that whereas in the latter the upper cells range only from 8–11 μ in diameter, in the New Zealand plant they are much larger, 15–20 μ. I have examined the specimens in Wilson's herbarium of "*Tortula chloronotos*, N.Zd., Colenso, 1446"; it is almost exactly like the European plant, with perhaps a slightly shorter seta, and the leaves possibly, but doubtfully, of a very slightly wider and shorter outline; the cell-structure, however, certainly differs. In European specimens of *C. chloronotos* (Crete, *leg.* Nicholson) the upper cells range from 6–10 μ in diameter, averaging perhaps 7–8 μ; they are irregularly rounded, and as a rule not very markedly seriate. In the New Zealand plant they are much more quadrate, and regularly arranged in longitudinal series; they range in width from 10–16 μ, averaging perhaps 13 μ. These measurements do not quite coincide with those given by Brotherus for the specimens examined by him, and are, indeed, somewhat intermediate between those and the European plant. Even so, however, they are markedly larger than in the latter, and I think the plant is probably quite entitled to specific rank.

It is, I believe, known only from Colenso's unspecified station in the North Island, and Reader's still less exactly defined locality in "New Zealand."

TORTULA Hedw.

This genus as now accepted represents the highest development of Pottieae, even as *Barbula* does in Trichostomeae. The plants are often tall and robust, but even when small are for the most part known at once by the more or less spathulate leaves with nerve usually—often longly—excurrent, rather large upper cells and lax, pellucid rectangular basal cells, the cylindrical capsule and long twisted peristome, often with a very long basal tube.

The following will serve partly as a guide to the systematic position and partly as a key to the species.

§ *Tortula sensu stricto* Limpr.

Plants small, stems short. Leaves small, ovate, oblong or oblong-lanceolate, about 2 mm. long, rarely 3 mm.; capsule small, elliptic or shortly cylindric; tube of peristome short.

1.	Leaves longly piliferous, nerve not thickened above	4. *muralis.*
	Nerve excurrent in a very short mucro	2
2.	Nerve stout, not thickened above	4
	Nerve distinctly thickened near apex	3
3.	Margin recurved, spores 18–21 μ	1. *atrovirens.*
	Margin plane, spores 12 μ	2. *submutica.*
4.	Leaves usually narrowed at apex, nerve excurrent in a minute hyaline apiculus	3. *phaea.*
	Leaves minute, broadly obtuse at apex, nerve excurrent in a thick, truncate mucro	14. *abruptinervis.*

§ *Zygotrichia* Brid.

Stem short. Leaves more or less spathulate, cuspidate (in the only New Zealand species strongly bordered); tube of peristome long.

Leaves with a strong white border, toothed near apex .. .. 5. *Petriei.*

§ *Syntrichia* Brid.

Plants usually robust with elongate stems. Leaves large, mostly 3 mm. or longer, usually cuspidate or aristate with the excurrent nerve. Tube of peristome long.

1.	Leaves more or less toothed above	2
	Leaves entire	4
2.	Nerve papillose at back	8. *rubra.*
	Nerve smooth at back	3

3. Leaves wide above, broadly pointed, coarsely toothed above, cells 7–10 μ .. 10. *serrata*.
Leaves narrowly acuminate, serrulate in upper part, cells 5–8 μ .. 9. *serrulata*.

4. Nerve excurrent in a yellowish point 5
Leaves usually widely spathulate, nerve excurrent in a red or hyaline arista 6

5. Leaves widely spathulate, concave, nerve gemmiparous, excurrent in a flexuose point .. .. 7. *papillosa*.
Leaves narrowly acuminate, nerve excurrent in a stout rigid cuspidate point 6. *flavinervis*.

6. Leaf-point variable, usually somewhat acute, arista short, red, or hyaline at tip only .. .. 11. *bealeyensis*.
Leaves spathulate, obtuse, arista hyaline for most of its length 7

7. Plants and leaves small, arista short, smooth or almost so .. .. 12. *tenella*.
Plants and leaves larger, arista long, denticulate .. .. .. 13. *princeps*.

§ *Tortula sensu stricto.*

1. **Tortula atrovirens** (Sm.) Lindb. de Tortul., p. 236 (1864).

Syn. *Grimmia atrovirens* Sm., Eng. Bot., xxviii, t. 2015 (1809). *Desmatodon nervosus* Bry. eur., fasc. 18–20, p. 6, t. 132; Fl. N.Z., ii, 71; Handb. N.Z. Fl., p. 421. *Trichostomum minutifolium* R. Br. ter in Trans. N.Z. Inst., vol. 29, p. 484. *Tr. apiculatum* R. Br. ter., *op. cit.*, p. 484. *Tr. Searellii* R. Br. ter., *op. cit.*, p. 484. *Tortula minuta* R. Br. ter., *op. cit.*, vol. 30, p. 404. *Tort. oamaruensis* R. Br. ter., *op. cit.*, vol. 35, p. 338. *Tort. arida* R. Br. ter., *op. cit.*, p. 338.

Distinct from all the remaining species of *Tortula*, except the next, in the very small size, very small oblong-spathulate leaves with a stout nerve which is markedly thickened near apex, and excurrent in a short mucro, the short seta—rarely if ever above ½ in., often much less—short elliptic capsule with shortly beaked lid, and imperfect peristome. The next species differs in the erect margin and smaller spores. The thickened nerve and recurved margin will together separate it easily from species of *Pottia*, which in habit it resembles more nearly than it does most species of *Tortula*.

The sixteen peristome-teeth are erect, united at base into a granulose ring, each divided into two filiform branches, which are often imperfect or even wanting, and sometimes articulated together. On account of the filiform branches the species has been removed from *Desmatodon*, in which genus as now restricted the teeth are broadened and flat, not filiform. The present species may be considered to unite *Tortula* with *Pottia*.

It is very variable in dimensions as well as in the development of the peristome. *Trichostomum Searellii* R. Br. ter. is a robust form with seta attaining ½ in.: *Tr. apiculatum* is a small form. *Tortula oamaruensis* is not found in Brown's herbarium, but the description and figures leave no doubt of its identity. It is one of the small forms. The other species cited above are there, and must also be referred here. The species is found in both North and South Islands.

2. **Tortula submutica** Broth. in Oefv. af Finska Vet-Soc. Förh., Bd. xl, p. 167 (1898).

I have not seen this plant. According to the description it differs clearly from the last in having the leaf-margins erect, the leaves incurved but scarcely contorted when dry, the spores only 12 μ in diameter.

The localities given are "Queenstown, Lake Wakatipu, et Anderson's Bay, ad rupes siccas (W. Bell)."

3. **Tortula phaea** (H. f. & W.) Dixon comb. nov. [Plate VIII, fig. 2.]

Syn. *Trichostomum phaeum* H. f. & W., Fl. N.Z., ii, 72 (1855); Handb. N.Z. Fl., p. 416. *Tortula lancifolia* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 404. *T. linearifolia* R. Br. ter., *op. et loc. cit.* *T. brevitheca* R. Br. ter., *op. cit.*, p. 405.

I have removed this plant to the genus *Tortula* on the following considerations: Wilson described the *Trich. phaeum* from very small material collected by Colenso on the shores of Lake Waihau, and makes the comment "specimens insufficient." Enough material remains, however, in Wilson's herbarium to identify the plant without doubt with one or two plants which I have been able to study, collected by R. Brown and by D. Petrie, and which are in sufficient quantity to give a good idea of the species.

Wilson in his herbarium has drawn careful sketches of the peristome, obviously—since only a fragment is drawn in each case, while the whole of the capsule-orifice is shown—from old capsules; and the actual material shows only such. There is nothing, therefore, to preclude the peristome, as shown, from being a fragment of a more highly developed one. The only other character in the description that would strongly incline in favour of *Trichostomum* is "margin flat" (Handb., p. 416). But Wilson has this MS. note in his herbarium: "Folia subcarnosa, margine plano, inferne vix reflexo, nervo continuo (integerrima), perich. latiora, erecta, operc. breviusculo (only loose ones seen). Teeth nearly free to the base, oblique. W. W." There are no lids now to be found among the material.

Wilson did not, therefore, find the leaf-margin absolutely plane; and in examining his material I find one leaf-margin frequently, perhaps usually, narrowly and shortly but clearly recurved below; and this is confirmed by R. Brown's specimens of *T. linearifolia* and *T. lancifolia*.

Of *T. linearifolia* Brown neither describes nor figures the peristome; but of *T. lancifolia* he describes it as "Peristome twisted, tube very short," and the peristome he figures is certainly that of a *Tortula* and may, I think, be relied on. All the capsules in his herbarium, unfortunately, of both species are without peristome.

I have, moreover, a plant from Oamaru, South Island, collected in September, 1892, by Mr. D. Petrie, which certainly belongs here, and which shows irrefutably a Tortuloid capsule and peristome. The vegetative characters agree exactly with Wilson's plant: the capsule is rather longer and more cylindric, the lid more than half the length of the capsule, the peristome red, rather short, but distinctly twisted, from a basal membrane or tube about one-fourth of its length. Colenso's original plant was no doubt a rather small form of the species.

On examining *T. brevitheca* R. Br. ter. I was at first disposed to consider it a new and distinct species. Since then, however, I have seen numerous gatherings of *T. phaea*, and have been reluctantly compelled to unite it with the latter species, of which it is a highly developed form, and no doubt the normal condition of the plant. The leaves are much longer and narrower, the lower strongly reflexed from an erect, typically Tortuloid base, the stems rather taller—about ½ in. high—and in better condition. Several, however, of the forms of undoubted *T. phaea* I have seen show a distinct transition in width and direction of leaf, and in all other respects the plants are identical, the brown colour, differentiated marginal cells, hyaline tip, and short capsule being especially noteworthy characters.

It is rather curious that among the various gatherings of this plant. under different names in Brown's herbarium. not one of them shows peristome in good condition. (His drawings. however. show the fully developed peristome in one or two cases.) This may be due to the conditions of growth. which appear to show an exposed and arid habitat. tending to the reduction of the sporophyte and its rather rapid destruction.

C. Müller (Gen. Musc. Fr., p. 418) refers *Trich. phaeum* to a section *Pycnophylla grosso-reticulata* with *Tr. brevicaule* Hampe from Java (*Gyroweisia brevicaulis* Broth.). having large rounded hexagonal cells and margins somewhat enrolled. &c., and capsule with conical lid. It is clear from this description that he had not seen Hooker and Wilson's original plant. and there is no doubt that he relied on specimens from Hampe so named, but not authentic. Hampe's specimens in point of fact are all Australian. and none of them agree with the actual *Tr. phaeum* H. f. & W.

The leaves of *T. phaea* are either elongate lingulate-lanceolate, or widely oblong-lanceolate. often spathulate. and this with the lax basal areolation and the fairly well developed peristome-tube indicates a *Tortula* rather than *Barbula*. The colour (from which the specific name) is characteristic, all the plants I have seen having a marked dark-brown, ustulate hue. R. Brown describes his *T. linearifolia* as having a pellucid border to the leaves. ceasing near the apex; this I have seen. but very rarely, and doubt if it can be considered a specific character. The apex of the leaf is frequently hyaline-tipped. and the structure of the nerve is rather peculiar. It is strong and deeply coloured throughout its length. but there is often or usually a thin dorsal layer of pale or hyaline cells near the apex. so that when viewed in longitudinal profile—which is easily done. as the leaves are somewhat strongly carinate-concave—there appears a thin line of hyaline. usually somewhat irregular or rugulose cells. rather markedly contrasting with the brown colour of the body of the nerve. The upper cells are rather clear. arranged more or less regularly in longitudinal rows. finely papillose. 9-13 μ in diameter; the basal lax. rectangular. empty. and pellucid. a number of rows of marginal cells being much shorter and subquadrate; in some leaves these rows preponderate, in others they are reduced to two or three.

The affinities of the species are not very clear. It is found in both North and South Islands.

4. **Tortula muralis** (L.) Hedw., Fund. ii, 92 (1782).

Syn. *T. pulvinata* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 400. *T. Binnsii* R. Br. ter., *op. cit.*, p. 402. *T. Gulliverii* R. Br. ter., *op. cit.*, p. 403. *T. Hutchinsonii* R. Br. ter., *op. cit.*, vol. 35, p. 339.

This well-known and almost cosmopolitan species scarcely needs description—the small dense tufts. oblong leaves. green. not reddish. with strongly recurved margins and long white hair-point. taken in conjunction with the small size and the short peristome-tube. are unlike any other New Zealand plant.

The three first-named plants of Brown's are in his herbarium. and are certainly *T. muralis;* no specimens are present of *T. Hutchinsonii*, but I think no one studying the description and figures in the volume cited could avoid the conclusion that it is merely *T. muralis*. The curious thing is that. being, as it appears, well distributed in New Zealand. it should have eluded the older collectors and does not appear in any of the earlier works.

§ *Zygotrichia.*

5. **Tortula Petriei** Broth. in litt. e Beckett in Trans. N.Z. Inst., vol. 29, p. 441, tab. 25 (1897).

Syn. *T. torlessensis* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 406 (1898).

In deference to Brotherus I retain this in *Zygotrichia*, though I find it difficult to assign any reasons why it should not be included in *Syntrichia*. Though the stems are short it is a robust plant—one of the finest and most distinct, in fact, of the New Zealand species. The leaves are large, stoutly bordered with a very broad, strong, whitish, yellow, or brown band of narrow elongate cells, concave, broadly pointed, coarsely toothed at apex, with the strong red nerve usually running out into a stout excurrent point. The seta is long, the capsule large, the peristome large and red with a very long tube.

Petrie collected it in Otago, and again on Kelly's Hill, Westland; Brown on Mount Torlesse and near Broken River. I do not know any other localities. It appears to be rare, and is a highly interesting species, standing quite by itself, and most nearly, while distantly, allied to one or two South American plants—*e.g.*, *T. denticulata* (Wils.) Mitt., which, however, has a far narrower border and larger, pellucid cells, and *T. Kunzeana* (C. M.) Mitt., which, while much like *T. Petriei* on a small scale, is in every way smaller and with quite minute cells.

Brown's specimen of *T. torlessensis* is identical with Petrie's plant.

T. Petriei will be found figured by Brotherus—Musci, i, fig. 284.

§ *Syntrichia.*

6. **Tortula flavinervis** Dixon comb. nov.

Syn. *Trichostomum grossirete* Broth. & Dixon in Journ. Linn. Soc. (Bot.), xl, 444, tab. 20 (1912).

This plant, collected sterile by the late Mr. James Murray, and described by us as a *Trichostomum*, appears to me now to be rather a *Tortula*. It has recurved leaf-margins; the cell-structure also resembles that of some species of *Syntrichia*. It is readily known by the long leaves, 1–1·5 mm. in length, stout nerve, longly excurrent in a straight, fragile, rigid, cuspidate yellowish point; the cells are 12–18 μ, the basal lax and elongate, as in most species of *Syntrichia*, but not reaching so high in the leaf as in many.

The original specific name is preoccupied by *Tortula grossiretis* Card. (Not. prélim. in Bull. Herb. Boiss., 2me. sér., vi, 6), so that I have been obliged to rename the present plant. It is probably most nearly allied to *T. pungens* H. f. & W., a Tasmanian moss which appears to have been overlooked by Brotherus. It is certainly a *Tortula*, and differs from the present plant in the wider, not fragile leaves, upper cells obscure with papillae, and a very stout nerve excurrent in a *very short* stout yellowish mucro.

7. **Tortula papillosa** Wils., Bryol. Brit., p. 135; Handb. N.Z. Fl., p. 418.

R. Brown (Trans. N.Z. Inst., vol. 30, p. 400) states that the New Zealand moss is not identical with the British species, from which "it differs in the gemmae being sessile, the nerve not being papillose, and the upper areolae being dense, while in the British plant the gemmae are stalked and the nerve papillose."

I was at first disposed to think that Brown had been misled, in part at least, by the figure in the Bryol. Britannica, which shows the gemmae slightly stipitate; on falling off, however, the gemmae lose the single-celled stalk (*cf.* Correns, Vermehr. der Laubmoose, figs. 45–50) and become subspherical. Moreover, examination of the New Zealand material in my herbarium failed to bear out Brown's statements, and showed no difference in cell or nerve structure from our British plant. The examination of fruiting material at Kew, however, somewhat explained matters. Specimens from Sealer's Cove, Victoria (F. Müller), showed the sporophyte very similar to that of *T. laevipila*, while the leaves agreed exactly with *T. papillosa*. The capsules were operculate, and I did not examine the peristome. There was one obvious difference—viz., that the seta twisted to the right, not to the left as in *T. laevipila* and most species of *Syntrichia*.*

When I examined the New Zealand fruiting specimens "27, N.Z., Mr. Travers, 1869" however, I noticed that the seta was a little longer (1·5 cm.), and also that it twisted in the reverse direction—*i.e.*, to the left. The same was the case with the specimens "N.Z., Prov. Canterbury, Sinclair & Haast, 1860 I." On examination of the leaves of Travers's plant it was at once evident that one had to do with an entirely different thing from *T. papillosa*. The gemmae appeared to be identical, but the leaf-structure was entirely different; the leaves, in fact, differed very little, if at all, from those of *T. princeps*, having the same spathulate form, though the upper ones were more concave than usual and with the margins often undulate. The nerve is red, smooth at back, excurrent in a long hyaline denticulate arista, red at base only; the leaf-margin here and there narrowly recurved, the cells small, and in the younger leaves obscure, a single row at margin usually being smaller, compressed and transversely elliptical, forming a rather conspicuous border here and there, but not constantly. The peristome-tube was much longer than the free part of the teeth, whereas that of the Sealer's Cove plant is described by Mitten as "peristomii parte tertia inferiore tubulosa." The New Zealand fruiting plants, in fact, belong to a gemmiparous form or variety of *T. princeps*, and this was no doubt the plant taken by R. Brown for *T. papillosa*, which must be looked upon at present as sterile only in New Zealand.

T. papillosa is easily known, apart from the gemmae, by the very concave, wide spathulate leaves with incurved margins, yellowish nerve papillose at back and excurrent in a yellow flexuous point, and by the very large cells (18–27 μ).

It appears to be uncommon in New Zealand, and is perhaps only known from the North Island.

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* It is necessary to call attention to the fact that botanists use these terms in contrary senses, according to whether the spiral is supposed to be viewed from within or without. If viewed from without and the nearer side ascends to the right, the farther side is obviously twisting to the left, and *vice versa.* Viewed from within, a spiral, whether to right or to left, turns in the same direction on all hands; and it appears to me, therefore, more free from ambiguity to assume this standpoint, and I use the term in that sense. It is, however, frequently used with the reverse intention—*i.e.*, the term "to the right" implies that the side of the spiral nearest to the spectator, viewing it from the outside, twists to the right. In view of this confusion it would probably be better to drop these terms altogether and use the terms "positive" and "negative," a "positive" spiral being one that turns in the direction of the hands of a watch, a "negative" one that turns in the reverse direction.

8. **Tortula rubra** Mitt. in Handb. N.Z. Fl., p. 419 (1867). [Plate VIII, fig. 5.]

Syn. *T. robusta* var. β H. f. & W., Fl. Antarct., ii, 409.
T. dioica R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 406.
T. serrulata Mitt. in Kew Journ. Bot., viii, 258 (*nec* Hook. & Grev.).

A handsome species with usually rather tall stems, the whole plant more or less reddish, the leaves not very closely set: it is one of the dioicous species, and is a much less frequent fruiter than most of the allied plants. The leaves are large, recurved, widely oblong-lanceolate from a comparatively short base, broadly pointed but rather acute, irregularly more or less but not very strongly dentate or denticulate, near the apex only, the margin usually narrowly recurved for a great part of its length, the nerve very stout and red, carinate, densely and finely papillose at back to very near the base, excurrent in a very short hyaline tipped point. The cells are fairly large and distinct, about 10–14 μ, several rows at margin rather smaller and more incrassate, often compressed and transversely elongate, forming a rather distinct coloured border. At the basal margin several rows are very narrow and incrassate, forming a distinct border, the outer row frequently papillose. I have called attention to the seriate papillae on the upper basal cells (Journ. Linn. Soc. (Bot.), xl, 445, t. 20, fig. 19).

I have seen it from both North and South Islands; it is probably, if rare, generally distributed, being found in Australia, Fuegia, the Falkland Islands, and South Georgia.

T. dioica R. Br. ter. is only *T. rubra*, from the author's own specimen.

Syntrichia punctulata Mitt. MS. in Herb. Kew. (Otago, Hector, 1863, No. 17 in Herb. Hook.) is *Tortula rubra*, in good fruit. The tube of the peristome is about equal in length to the free part.

9. **Tortula serrulata** Hook. & Grev. in Brewster, Edinb. Journ., i, 298 (1824); Fl. N.Z., ii, 70; Handb. N.Z. Fl., p. 419. [Plate VIII, fig. 4.]

Syn. *Barbula serrulata* Brid., Bryol. Univ., i, 833.

Very similar in habit to *T. rubra*, and I believe, like that, dioicous, but usually shorter and less robust; it is recognizable at once by the leaves, which are smaller, narrower in outline, more narrowly and sharply acuminate, the margin less recurved, more sharply and more regularly dentate for a greater part (one-quarter to one-third) of its length, and especially by the nerve quite smooth at back, and the much smaller, very obscure cells, 5–8 μ in width, scarcely differentiated at margin. For the differences between it and *T. serrata* see under the latter.

I have seen it from both North and South Islands. It is also found in Fuegia, and is recorded by Paris from the Falkland Islands.

10. **Tortula serrata** Dixon sp. nov. [Plate VIII, fig. 3.]

T. serrulatae affinis; differt caespitibus supra *saturate viridibus*, infra rufis; foliis *valde fragilibus, latioribus*, oblongo-lanceolatis, *breviter late acutis*, marginibus *e medio folio grosse dentatis* superne saepius *dentibus rubris intermixtis argute spinuloso-serratis*; cellulis *paullo majoribus*, 7–10 μ latis; fol. perichaetialibus apice *latiore, grosse irregulariter dentatis, dentibus saepe pulchre rubellis.*

Hab. Masterton, Wairarapa, North Island, on trees, and among silt at base of cabbage and willow trees; 1909, &c.; *leg.* W. Gray (Nos. 46, 78). Fendalton, Wairarapa, *leg.* R. Brown ter.

Although clearly allied to *T. serrulata*, this seems to be a well-defined species. *T. serrulata* (judged by herbarium specimens only) appears to be of a paler, reddish colour; the leaves taper gradually to a narrow acumen; the serratures are fairly strong, and are frequently intermixed with small, pellucid, spinulose cells. Here the deep-green colour and the very fragile leaves appear to have some significance; the leaves are in outline almost as in *T. rubra;* the serrations above are very coarse and irregular, large reddish pellucid teeth being mixed with smaller papillose obscure ones; and the perichaetial leaves especially show a marked difference. In *T. serrulata* these are very narrowly and finely, rigidly acuminate, the pale margin formed by a rather distinct border of elongate, more pellucid cells, and only very slightly denticulate. In the present species they are wider above, with very coarse irregular serration, the large, numerous deep-red spinulose teeth often forming a very beautiful contrast to the deep-green chlorophyllose lamina cells. The lamina is very fragile, often leaving the stout red nerve almost entirely bare. I have attempted to show the principal leaf-characters distinguishing these three species on Plate VIII.

Both species are dioicous; I have not found any difference in the sporophytic characters.

Numerous species of this group with serrated leaf-margins have been described from South America (Fuegia, &c.), but none of them appear to agree with our plant. *T. pseudo-robusta* Dus. is perhaps the nearest, but is a much taller, more robust species, with longer, more gradually tapering leaves, more regularly toothed, with distinct aculeate teeth and somewhat different areolation. It has also a different peristome, the tube being about three-quarters the length of the whole; in *T. serrulata* and *T. serrata* it is only about half the length.

11. **Tortula bealeyensis** R. Br. ter. in Trans. N.Z. Inst. vol. 30, p. 403, t. 37 (1898).

Syn. *T. Stevensii* R. Br. ter., *op. cit.*, p. 405. *T. kowaiensis* R. Br. ter., *op. cit.*, p. 406. *Barbula austro-alpina* C. M. in Hedw., xxxvii, p. 121 (1898). *Tortula austro-alpina* Broth. in Engler and Prantl, Pflanzenfam., Musci., i, 435.

This species is very distinct among the entire-leaved aristate Syntrichiae, by the almost smooth red arista, hyaline only at tip, very short, often in fact forming only a stout red cuspidate point; the leaves are much less spathulate and more acute than in the two following species, and more of the outline of *T. rubra*, of which also they have almost the areolation, but the cells are less papillose, the margin entire, and the very stout red nerve smooth at back. The marginal band of smaller more incrassate cells is broader than in most of the species where it occurs, and more distinct.

It is one of the finest of the New Zealand species, being a robust tall plant, reddish in colour, with long seta and large capsule.

Specimens of the three species of Brown's cited above are in his herbarium, and all belong to one and the same species; the variability which obtains to some extent in the degree of acuteness of the apex accounts in great part for this duplication.

I have examined *B. austro-alpina* C. M. ("Peel Forest, Canterbury, Jan., 1900, T. W. N. Beckett") at Kew, which, although not the original gathering, may no doubt be relied upon as being C. Müller's species. It is identical with *T. bealeyensis* R. Br. ter. (Brotherus has remarked that *B. austro-alpina* is autoicous, not dioicous as stated by C. Müller.)

The question of priority is not an easy one to solve. C. Müller's species was published in a part of Hedwigia issued 25th June, 1898, while the volume of the Trans. N.Z. Inst. in which Brown's paper was published was issued in June, 1898. Brown's paper was read on the 4th August, 1897, and this perhaps should weigh in a doubtful case such as this, and I have therefore retained his earliest name.

Syntrichia bryoides Mitt., MS. in Herb. Kew., "Prov. Canterbury, N.Z., Sinclair and Haast, 1860–1," also belongs here.

The published records are all, I believe, from the South Island. Dr. Cockayne has sent me the plant from several localities, all in that Island. I have it also from Lake Wakatipu.

12. **Tortula tenella** Broth. in Oefv. af Finska Vet-Soc. Förh., xl, 168 (1898).

Syn. *T. acuta* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 400 (1898) (*nec T. acuta* Brid., Sp. M., i, 265). *T. elliptotheca* R. Br. ter., *op. cit.*, p. 401. *T. oblongifolia* R. Br. ter., *op. cit.*, p. 401.

The correct name for this species, like the last, is not quite easy to determine. Brotherus's name was published in the yearly volume cited, which appeared some time during 1898. As it contains reports of meetings held during May, 1898, the presumption seems to be that it could hardly be issued so early as June of that year, in which month the volume containing Brown's species was published. *T. acuta* R. Br. ter. is, however, invalidated by *T. acuta* Brid., and *T. oblongifolia* by *T. oblongifolia* Wils. *T. elliptotheca* might be held to be the correct appellation, but the name, together with the description and figure, indicating an elliptic capsule, raises a point of doubt as to whether Brown actually intended to describe the same plant as Brotherus (where the capsule is cylindric); the specimen in his herbarium under this name (*T. elliptotheca*) has a single capsule only, which, though small, is certainly cylindric, and belongs undoubtedly to the same species as *T. tenella*.

A further difficulty lies in the inflorescence, R. Brown describing all the three plants cited above as "monoecious." Brotherus describes his *T. tenella* as dioicous, and a careful examination of Petrie's original specimens has failed to reveal any male inflorescence on the fruiting plants, and I have no reason to doubt the correctness of Brotherus's diagnosis. There is, I think, however, a good deal of reason to question the accuracy in the case of Brown's descriptions. I am inclined to think that in general he considered plants that as a rule produced capsules in quantity to be monoecious, without necessarily having carefully dissected them. He gives no description in any case of the character of the male inflorescence, nor is there any indication in his descriptions or figures, or in his herbarium, of his having dissected any of the species. Moreover, the only two species for which he describes the inflorescence as anything but "monoecious" he has named *T. synoecia* and *T. dioica*, implying, I think, that he considered any departure from the monoecious type as of so marked a nature as to be the chief or a leading specific character; whereas several of the other New Zealand species are dioicous, and *T. princeps* is at least often synoicous. The specimens in his herbarium are too meagre to allow of dissection to settle the point, but I am of opinion that his diagnosis in this particular may be ignored.

In view of these ambiguities it appears best to give Brotherus's name the benefit of the doubt that exists as to priority.

Brown's name, *T. acuta*, is rather inappropriate: the plant is in many respects a miniature of *T. princeps*, and the leaves are normally rounded and obtuse at apex; and if some of the leaves in Brown's plant are slightly acute, this is certainly not the case with the majority of them: the most that can be said is that they are not quite so broadly rounded as is sometimes the case.

T. tenella, as has been remarked, is in many respects a miniature of *T. princeps*; but, apart from the dioicous inflorescence and general smallness of all the parts, the excurrent arista is short, and almost smooth, the cells a shade larger. The tufts are dense, and dark brown as if burnt up.

T. monoica Card., Not. prélim. in Bull. Herb. Boiss., 2me sér., v, 1003, from the Falkland Islands, must be, from the description and figures, identical with *T. tenella* in almost every respect except the autoicous inflorescence.

The locality of Petrie's plant was in Central Otago; Brown's were all gathered on the Lyttelton Hills, Canterbury.

13. **Tortula princeps** De Not., Syll. Musc. in Ital., p. 170 (1838).

Syn. *Barbula princeps* C. M., Syn., i, 656. *Barbula Muelleri* Bry. Eur., fasc. 13–15, p. 44 (1842). *Tortula Muelleri* Wils., Bry. Brit., p. 134; Fl. N.Z., ii, 70; Handb. N.Z. Fl., p. 419. *Barbula antarctica* Hampe & C. M., in C. M. Syn., i, 638. *Tortula antarctica* Broth. in Engler and Prantl, Pflanzenfam., Musci, i, 435. *Barbula pseudo-antarctica* C. M. in Hedw., xxxvii, 121. *Tortula pseudo-antarctica* Broth., *op. et loc. cit.* *Tortula cuspidata* H. f. & W., Fl. Tasm., ii, 175. *Tortula rubella* H. f. & W., *op. cit.*, p. 176. *Tortula Maudii* R. Br. ter. in Trans. N.Z. Inst., vol. 30, p. 401. *T. synecia* R. Br. ter., *op. cit.*, p. 402. *T. panduriforma* R. Br. ter., *op. et loc. cit.* *T. Searlii* R. Br. ter., *op. cit.*, p. 403.

The long synonymy here given is in great measure due to uncertainty as to inflorescence. *T. princeps* is primarily a synoicous moss, and failure to detect antheridia in the female flower has no doubt led to the separation of species on this, the slightest of grounds; for it has been shown that *T. princeps* is normally polyoicous, purely female flowers occurring side by side with the synoicous ones. Mitten has called attention to the need of examination of plentiful material in this group before concluding from the apparent absence of antheridia that a plant is dioicous. This omission has, I doubt not, led to the creation of *Barbula pseudo-antarctica* C. M., although I have not seen specimens; the author has fallen into this error in more than one of the species described in that paper, and there is nothing in the description to indicate any difference from *T. princeps*.

I have examined the type specimen of *Barbula antarctica* Hampe & C. M. in Hampe's herbarium, as well as Wilson's specimens and notes, and am quite of Wilson's opinion that it differs in no way from *T. princeps*. The comparison of the authors with *T. laevipila* is unaccountable, as in every way it is, as Wilson remarks in his herbarium, "certainly much more nearly allied to *T. Muelleri* than to *T. laevipila*." They rely upon characters of little value, and not by any means constant in their own type: *e.g.*, "foliorum forma apice retuso," which is not at all borne out by Hampe's specimens.

T. princeps varies greatly in size, and to some extent in the length and roughness of the arista, the degree of recurving of the margin, of the obtuseness of the apex, and of the size of the cells; but even these variations are confined within narrow limits, and are rarely constant as between all the leaves on a single stem, so that I must confess to some inability to see why this particular plant has been subjected to so much "splitting" as compared with many other much more variable species.

All the species of Brown's cited above as synonyms occur in his herbarium, and present no differences from *T. princeps* except in size and one or two quite minor characters.

Rodway (Tasmanian Bryophyta, Mosses, p. 16) cites *T. pandurifolia* Hpe. & C. M. as a synonym of *T. princeps*. An examination of Hampe's material at the British Museum would have led me to the same conclusion but for the fact that it is described as dioicous, and my examination, so far as it went, would support this view. Brotherus places it in a section with gemmiparous leaves, like *T. papillosa*, and the question arises if the gemmiparous plant taken by Brown for *T. papillosa* and referred to under that species could belong to *T. pandurifolia*. I am inclined to think that more than one species of this group may, like the European *T. laevipila*, have a gemmiparous form, in which case—since no dioicous species of this group appear to be found in New Zealand—it would be natural to suppose that the New Zealand plants in question represented a gemmiparous form of *T. princeps*, while *T. pandurifolia* was a similar form of one or the other allied dioicous Australian species.

T. princeps is known at once from the other New Zealand species by its synoicous or autoicous inflorescence, widely spathulate, obtuse leaves, with the red nerve excurrent in a long, more or less denticulate, hyaline arista. It appears to be common, and, like the European plant, is very variable in size and habit.

§ *Tortula sensu stricto* Limpr.—*continued.*

(The following species was determined too late to be placed in its proper sequence.)

14. **Tortula abruptinervis** Dixon sp. nov. [Plate VIII, fig. 6.]

Perminuta; caespites densissimas virides parvas formans; caules 2–3 mm. tantum alti, hic illic parce ramosi. Folia conferta, erecto-patentia, sicca *arcte spiraliter contorta, nervo pallido dorso valde nitente;* minima, vix 1 mm. longa, *lingulata*, apud medium paullo angustata, dehinc supra paullo dilatata subspathulata, *apice late rotundato-obtusa;* marginibus *planis*. Costa valida, fusca, superne *nullo modo angustata, apicem versus carinata*, dorso prominens, laevis, *in mucronem brevem, crassum, truncatum, nullo modo acutatum*, excurrens; sectione supra duces 2 medianos, comitum fasciculum parvum, cellulas dorsales substereideas homogeneas, fuscas, ventrales paucas majores papillosas exhibens.

Cellulae superiores majusculae, 10–14 μ latae, distinctae, chlorophyllosae, papillis bi-trifidis praecipue ad marginem coronatae. Areolatio basilaris pellucida, cellulis medianis hyalinis, rectangularibus, ad marginem seriebus 3–4 brevioribus, subquadratis, chlorophyllosis.

Propagula numerosa, magna, in foliorum axillis sita, eis *T. pagorum* (Milde) simillima, 250 μ longa vel ultra, *fusiformia*, perviridia, apice acuto, *hyalino*.

Fructus ignotus.

Hab.—On trees, with Orthotricha, &c.; bank of Waipoua River, Masterton, Wairarapa; Nov. 1914; W. Gray, No. 213.

A very distinct, minute species, with somewhat the habit of the smaller species of *Zygodon*; but the basal areolation, the papillae of the cells, and the nerve section undoubtedly indicate *Tortula*. The peculiar abruptly truncate nerve mucro is reminiscent of the proboscoid abnormal leaves of many species of *Calymperes*. The gemmae are very noteworthy, and exactly similar to those of *T. pagorum* (Milde) De Not. (*cf.* Limpr., Laubm. i. fig. 186), but much larger in proportion to the leaves.

EXPLANATION OF PLATES.

Plate VII.

Fig. 1. *Fissidens leptocladus* (Kaitangata; Beckett). *a*, plant, nat. size. *b*, leaf, × 20. *c*, leaf-apex, × 40. *d*, upper cells, × 200.

Fig. 2. *F. inclinabilis* (herb. C. Müller). *a*, plant, nat. size. *b*, leaf, × 20. *c*, leaf-apex, × 40. *d*, upper cells, × 200. *e*, capsules, × 8.

Fig. 3. *F. campyloneurus*. *c*, leaf-apex, × 40.

Fig. 4. *Dicnemon calycinum*. *a*, *a′*, perichaetia, × 3.

Fig. 5. *D. semicryptum*. *a*, perichaetium, × 3.

Fig. 6. *Dicranodontium australe* (type). *a*, plant, nat. size. *b*, leaf, × 20. *c*, leaf-apex, × 40. *d*, cells of subula, × 200. *e*, supra-basal, juxta-costal cells, × 200. *f*, do., marginal, × 200.

Fig. 7. *Campylopus Holomitrium* (N.Z.; Walker). *a*, leaf-base, × 40.

Fig. 8. *C. arboricola* (Te Aroha). *a*, plant, nat. size. *b*, leaf-apex, × 20. *c*, leaf-base, × 30. *d*, upper cells, × 200. *e*, leaf-section near base, × 40.

Fig. 9. *C. bicolor* (Stewart I.; Brown). *a*, leaf-base, × 20.

Fig. 10. *C. Kirkii* (Stewart I.; Brown). *a*, leaf-base, × 20.

Fig. 11. *C. nudus* (type; herb. Hampe). *a*, leaf, × 8. *b*, leaf-base, × 40. *c*, apex of subula, × 40. *d*, lower cells, × 200. *e*, cells of subula, × 200.

Plate VIII.

Fig. 1. *Eucladium irroratum*. *a*, leaf, × 20. *b*, apex of do., × 50. *c*, upper marginal cells, × 200. *d*, mid-basal cells, × 200.

Fig. 2. *Tortula phaea* (ex herb. Wils.). *a*, leaf, × 20. *b*, apex of do., × 50. *c*, upper marginal cells, × 200.

Fig. 3. *Tortula serrata*. *a*, leaf-apex, × 40.

Fig. 4. *Tortula serrulata*. *a*, leaf-apex, × 40.

Fig. 5. *Tortula rubra*. *a*, leaf-apex, × 40.

Fig. 6. *Tortula abruptinervis*. *a*, stem, × 4. *b*, *b′*, leaves, × 20. *c*, leaf-apices, × 40. *d*, leaf-apex, × 100. *e*, upper marginal cells, × 200.

Fig. 7. *Barbula rostrata*. *a*, *a′*, leaves, × 20. *b*, three leaf-apices, × 40. *c*, upper cells, × 200. *d*, cells of extreme base near nerve, × 200.

Fig. 8. *Tortella rubripes* (ex herb. Mitt.). *a*, leaf, × 20. *b*, *b′*, leaf-apices, × 40.

Fig. 9. *Pottia areolata* (*Pottia Whittonii*, R. Br. ter.). *a*, *a′*, leaves, × 20. *b*, apex of leaf, × 40. *c*, upper cells, × 200.

Fig. 10. *Tortula bealeyensis*. *a*, leaf, × 20. *b*, *b′*, leaf-apices, × 10. *c*, upper marginal cells, × 200.

PLATE VII.

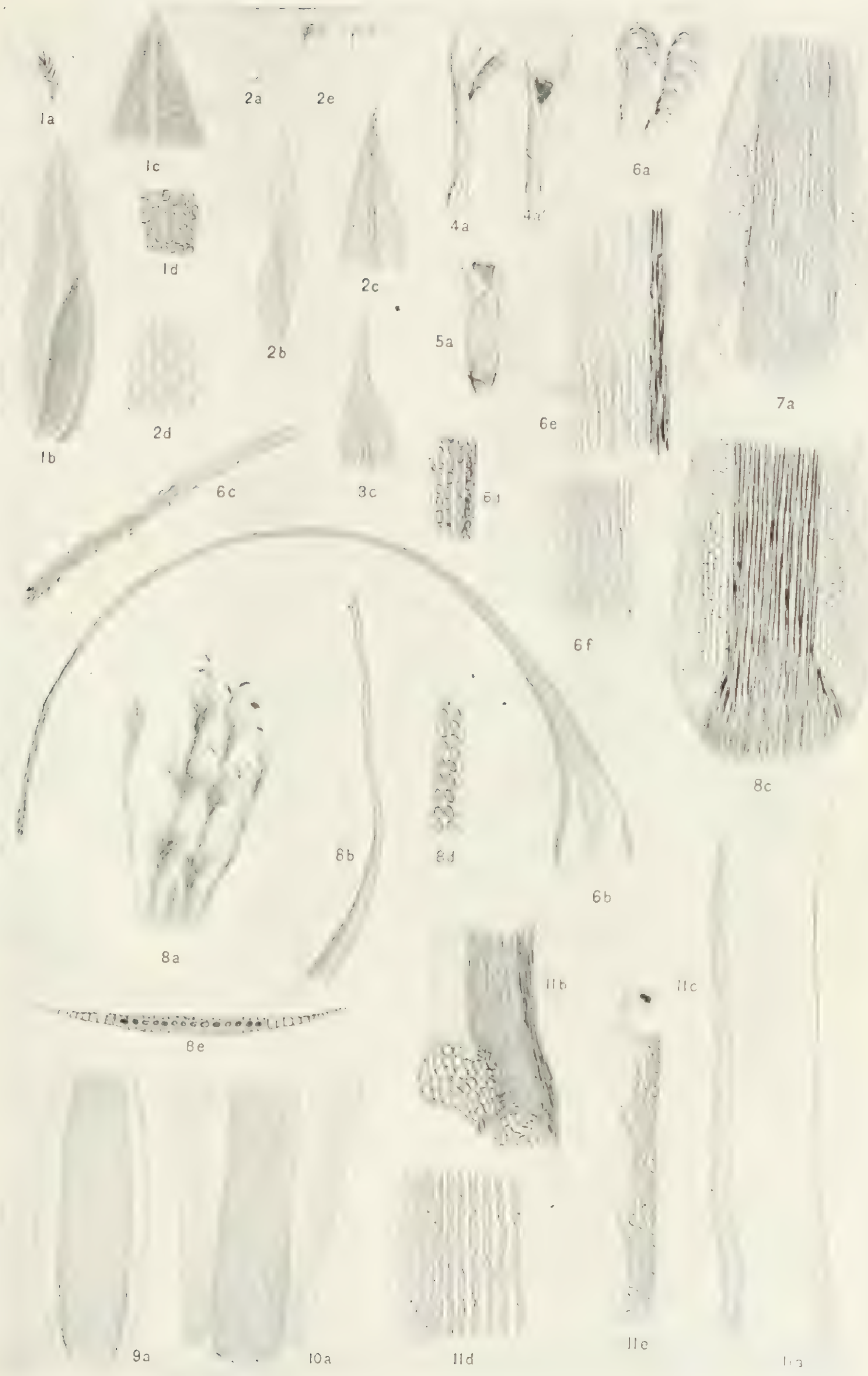
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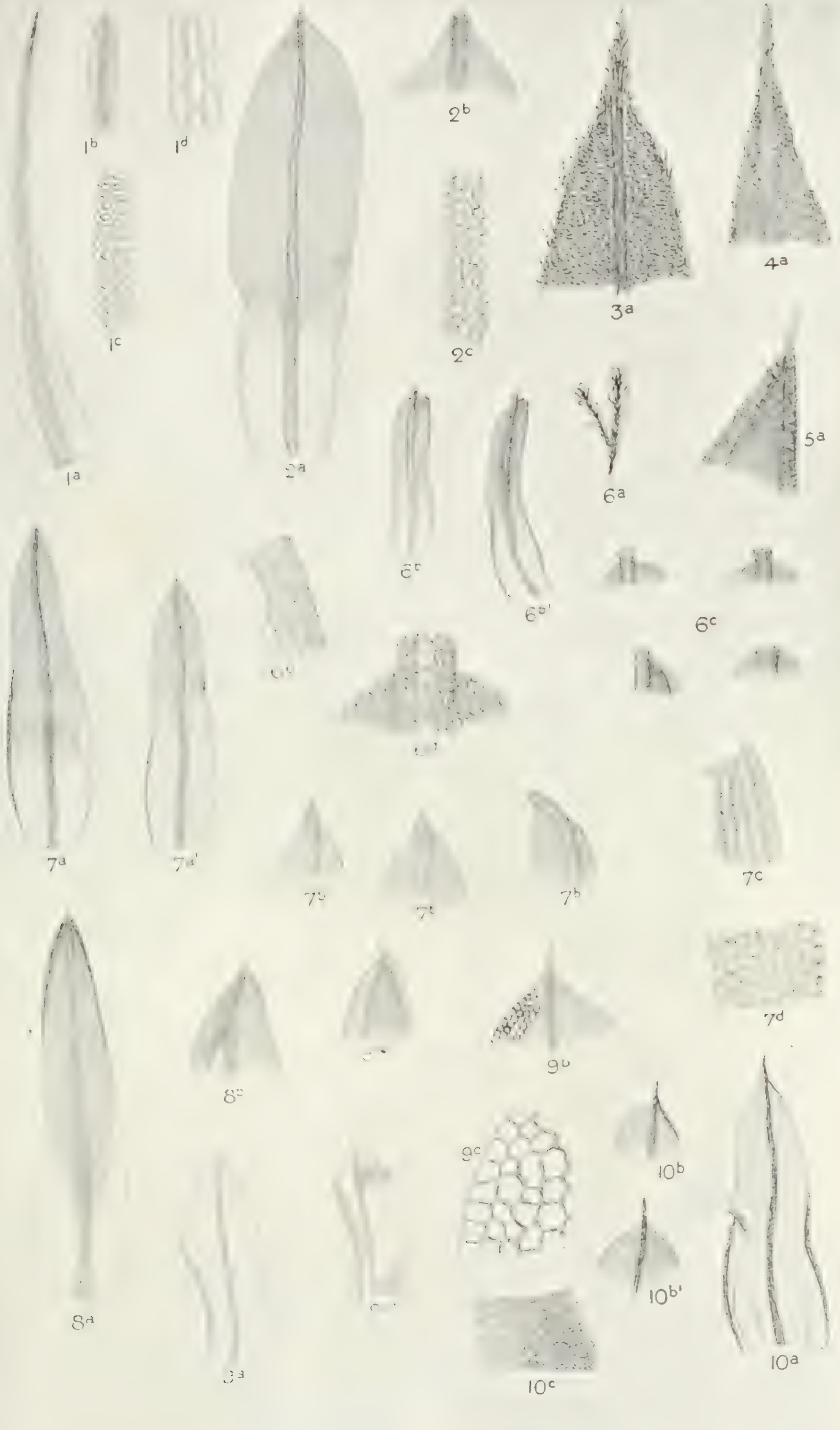
PLATE VIII.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NEW ZEALAND INSTITUTE.

BULLETIN No. 3.

STUDIES IN THE
BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF ROBERT BROWN,
OF CHRISTCHURCH, NEW ZEALAND.

BY H. N. DIXON, M.A., F.L.S.

PART IV.

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PART IV.

Plate IX.

ENCALYPTACEAE.

Encalypta Schreb., Gen. ii, p. 759 (1791).

Encalypta vulgaris Hedw., Sp. Musc., p. 60 (1801).

> Syn. *E. tasmanica* Hampe in Linn., 1853, p. 491. *E. australis* Mitt. in Journ. Linn. Soc. (Bot.), iv, p. 72 (1859); Handb. N.Z. Fl., p. 422. *E. novae-seelandiae* Col. in Trans. N.Z. Inst., 1864, p. 348.

I do not think it is necessary to labour the question as to the identity of the Australasian plant with the European species. The most that has been said for it, I believe, is that it has less rounded apices of the leaves, and a smooth tip to the calyptra, while the geographical distribution must be taken into account, as *E. vulgaris* is at least not generally distributed in the Southern Hemisphere; and if it were, in its normal form, absent from the Australasian region it might at any rate lend some colour to the theory that the plant found somewhat widely in this region was specifically distinct. Since, however, the ordinary form of *E. vulgaris* with roughened calyptra-tip exists in Tasmania side by side with the smooth-tipped form (*cf.* Bastow, "Tasmanian Mosses," p. 61), this last argument disappears altogether.

As regards the obtuseness of the leaf-apex, it is of no value whatever; the northern plant varies greatly, and the pointed tip is at least so frequent that Limpricht (Laubmoose, ii, 108) describes and figures this form as the normal one. The smoothness or roughness of the calyptra-tip has little more importance. Smooth forms occur not infrequently in the Northern Hemisphere. Boulay ("Muscinées de la France," p. 316), in writing of the various forms of this species, says: "Quand la coiffe se rencontre lisse avec des feuilles apiculées, c'est l' *E. laevigata* Bruch." It must not be deduced from this last statement that the smooth calyptra is always correlated with the pointed leaves; Limpricht in fact describes the plant and figures it with pointed leaves, but makes a point of the scabrous tip of the calyptra. There remains, therefore, not a scrap of foundation for separating the New Zealand plant from *E. vulgaris*. It is probably widely distributed throughout New Zealand.

GRIMMIACEAE.

Ptychomitrium Fuernr. in Fl., 1829, p. 19.

Syn. *Glyphomitrium* Brid., Mant. M., p. 31, p.p. (1819). *Brachysteleum* Reichenb., Consp. (1828), p. 34.*

So far as I am aware, no species of this very distinct genus have hitherto been credited to New Zealand, though several are recorded from Australia and Tasmania. I find, however, in Brown's herbarium two highly interesting plants, described as new species of *Grimmia*, which belong here; one of them, *G. Turneri* R. Br. ter., being identical with *P. australe* (Hampe, as *Brachysteleum*), the other, *G. Barrii* R. Br. ter., a distinct new species.

The plants of this genus are generally readily known by their compact, blackish tufts usually growing on rocks, with leaves of dense, rather solid texture, generally obtuse and often cucullate at apex, strongly curled when dry, and by the usually abundant capsules of *Grimmia* form but exserted on long, erect setae; and especially by the long, mitriform calyptra, covering most of the capsule, like that of *Rhacomitrium*, but plicate from top to bottom.

The two New Zealand species will readily be distinguished from one another by the following characters, among others :—

Tufts large, ¾ in. high, robust; leaves broad above, subobtuse, slightly cucullate at apex, but not incurved. Capsule turgidly elliptic	1. *australe.*
Much smaller in all its parts, scarcely ¼ in. in height; leaves narrow, with a strongly incurved, hooked subula. Capsule narrower, with a more tapering base	2 *Barrii.*

1. **Ptychomitrium australe** (Hampe) Jaeg., Adumbr. i, p. 383 (1872–73).
Syn. *Brachysteleum australe* Hampe in Linn., 1856, p. 209. *Grimmia Turneri* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 336 (1902). *Pt. Adamsonii* Jaeg. Adumbr. i, 381. *Glyphomitrium Adamsonii* Mitt. in Journ. Linn. Soc., Bot., iv, 73 (1859).

Gathered by Brown on rock on the north side of Mount Torlesse, in January 1900, in which habitat he states it is common. Also by Berggren, Tauranga, North Island, 1874 (No. 1044).

Distrib.—Australia—Victorian Alps; Melbourne.

Brown's discovery of this plant, which agrees well with the type in Hampe's herbarium in the British Museum, is especially interesting because it has not been collected elsewhere except in the original locality by F. Mueller.

The leaves, curled when dry, and the areolation, lacking the sinuose basal cells of *Rhacomitrium*, will separate it at once from *R. crispulum* var. *rupestre*.

Grimmia nigra R. Br. ter (MS. in herb.), from Mount Torlesse, is also this species; as is also *Glyphomitrium Adamsonii* Mitt., from original specimens in Herb. Kew.

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* For the choice of generic name *cf.* Cardot in Rev. bryol., 1913, pp. 41, 43.

2. Ptychomitrium Barrii (R. Br. ter.) Dixon comb. nov.

Syn. *Grimmia Barrii* R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 337 (1902).

Hab.—Near Weston, Oamaru, Nov., 1897. Kennedy's Bush, Lyttelton Hills, on stones (in herb. R. Br. ter. as *Rhacomitrium protensum*).

Very distinct from all the species I know in the small size and strongly hamate leaves in their upper portion.

GRIMMIA Ehrh, in Hedw. Fund., ii, p. 89 (1782).

R. Brown has described twenty-six new species in Trans. N.Z. Inst., vol. 27, and five more in vol. 35; very few of these, however, can stand. The bulk of them belong to the subgenus *Schistidium*, and are forms of the highly polymorphous *G. apocarpa*, the variability of which cosmopolitan species Brown does not appear to have recognized.

The new species in vol. 27 are grouped by him under two heads—"Columella adhering to the operculum" and "Columella not adhering to the operculum." Under the latter are placed several species which, either from specimens in his herbarium or from the descriptions and figures, clearly belong to the subgenus *Schistidium*; but the adherent columella is a fixed character of this subgenus, and I can only suppose that there was in these cases an error of observation.

Only about half of the new species are to be found in Brown's herbarium, but the descriptions and figures of the rest make it tolerably easy to refer them to one or other of the already described species.

I have arranged the species under the classification given by Brotherus in the "Musci"; the following key will make the arrangement clear:—

Subgen. SCHISTIDIUM. Autoicous. Capsule immersed on an extremely short, erect seta; short and wide, usually more or less wide-mouthed and hemispherical when mature. Columella falling away with the lid.	
Terrestrial, densely coespitose; upper leaves, at least, with long hair-point (rarely hairless)	1. *apocarpa.*
Aquatic; elongate; leaves with a broad, usually obtuse, hairless apex	1. var. *rivularis.*
Subgen. GASTERO-GRIMMIA. Autoicous. Capsule immersed, placed asymmetrically on the very short, curved seta. Columella unattached to the lid ..	2. *argentea.*
Subgen. GRIMMIA sensu stricto. Capsule exserted on a longish, straight seta, erect, smooth. Lid mitriform. Leaves wide at points, plane-margined	3. *campestris*
Subgen. RHABDOGRIMMIA. Capsule exserted on a curved seta, ribbed when dry.	
Leaves long and narrow, gradually tapering to a narrow point; basal cells narrow, elongate, linear	4. *trichophylla.*
Leaves shorter, wide at points, basal cells all short, rectangular, peristome-teeth spreading when dry	5. *pulvinata* var. *obtusa.*
Leaves as in the foregoing; peristome-teeth strongly reflexed when dry	5. *pulvinata* var. *basaltica*

1. **Grimmia apocarpa** (L.) Hedw., Descr. i, p. 104 (1787).

Syn. *G. hedwigiacea* C. M. in Hedwig. xxxvii, p. 164 (1898), *G. Searellii* R. Br. ter in Trans. N.Z. Inst., vol. 27, p. 410 (1895). *G. revisa* R. Br. ter., *op. et loc. cit.* *G. cyathiformis* R. Br. ter., *op cit.*, p. 411. *G. Alfredii* R. Br. ter., *op. cit.*, p. 412. *G. turbinata* R. Br. ter., *op. et loc. cit.* *G. Laingii* R. Br. ter., *op. cit.*, p. 413. *G. gracilis* R. Br. ter., *op. cit.*, p. 414. *G. minime-perichaetialis* R. Br. ter., *op. et. loc. cit.* *G. oamaruensis* R. Br. ter., *op. cit.*, vol. 35, p. 336 (1902).

Forma **mutica**.

Syn. *G. mutica* Hampe in Linn., 1859–60, p. 631. *G. Mitchellii* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 411.

Var. **rivularis** (Brid.) Web. & Mohr.

Syn. *G. flexifolia* Hampe in Linn., 1859–60, p. 632. *G. subflexifolia* C. M. in Hedwig, xxxvii, p. 164. *G. Beckettiana* C. M., *op. cit.*, p. 163. *G. aquatica* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 409. ("*G. aquatilis* R. Br.," Broth. Musci, p. 448, is an error; no such species exists.)

Var. **pumila** Schimp., Syn. Ed., ii, p. 243.

Syn. *G. saxatilis* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 411. *G. maorica* Par. Ind. Suppl., p. 174. *G. Wrightii* R. Br. ter., *op cit.*, p. 413.

Of the above reductions I have examined specimens of the larger number, and of the rest the descriptions leave practically no doubt of the identity of the respective plants with one or other of the many forms of *G. apocarpa*.

The forma *mutica* appears to me a slight form merely; the leaves may be quite hairless or with very short and inconspicuous hyaline points; the other distinguishing characters enumerated by Hampe do not appear to have any importance.

One of Brown's specimens, an ordinary form of *G. apocarpa*, was collected in a very unusual habitat for this species—viz., on poplar-trees near the River Avon. The bark of the tree still remains attached to the plants, so that there is no doubt as to the correctness of the record.

The var. *rivularis* is a very marked and distinct plant, and it is possible should be considered a distinct species, as it is treated by some authors. Limpricht has pointed out structural characters of some importance. On the other hand, the fact that the form, otherwise not widely distributed in the Southern Hemisphere, is associated in this region with *G. apocarpa* type is certainly an additional argument in favour of its being a derivative of *G. apocarpa* rather than an independent species. I know of no area, in fact, where the var. *rivularis* occurs from which *G. apocarpa* is absent.

Specimens of *G. flexifolia*, collected by Beckett, and determined by Brotherus, as well as *G. aquatica* R. Br. ter., and other gatherings in Brown's herbarium, exhibit no differences from our northern *rivularis*.

The var. *pumila* is a fairly well marked form, usually reddish-brown, in dense, small tufts, with small, narrow leaves and a smaller capsule.

2. **Grimmia argentea** R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 412.

Apparently a very rare species ; it is placed by Brown under *Schistidium*, but in reality belongs to *Gastero-grimmia*. The difference from *Schistidium* is not at first sight easy to detect, but on dissection it will be found that the capsule is not erect and symmetrical on a short straight seta as in *Schistidium*, but is swollen at the base on one side, so that the very short curved seta appears to be inserted on one side of the base (*cf.* Plate IX, fig. 1*b*).* The plant may, however, be known from all the forms of *G. apocarpa* by the very broad, concave leaves with non-sinuose cells (especially at the base), and very long, broad, spinulose, hyaline points, giving the plant a characteristic silvery appearance.

It has not, I believe, been rediscovered.

3. **Grimmia campestris** Burch. in Hook., M. Exot., ii, t. 129 (1820).

Syn. *G. leucophaea* Grev. in Wern. Trans., iv, p. 87 (1822). *G. leiocarpa* Tayl. in Lond. Journ. Bot., 1846, p. 44 (*fide* Brotherus). *G. Bellii* R. Br. ter. in Trans N.Z. Inst., vol. 27, p. 416.

An almost cosmopolitan species on warm, exposed siliceous rocks. It appears, however, not to be common in New Zealand. Beckett records it in Trans. N.Z. Inst., vol. 25, as *G. leucophaea*. I have only seen it from the South Island. It may, however, have been overlooked. In fruit it is easily recognized, as the erect, smooth, exserted capsule on a short, straight seta is unlike that of any of the other species. The dark-grey colour of the tufts or patches, which are usually extended, and crumble to pieces at once on gathering ; the wide leaves with plane margins ; and especially the long, broad, very rough hair-points, will separate it from all the species, even without fruit.

It is perhaps in leaf form and structure most like to *G. argentea*, but the two are not likely to be confused ; and the nerve in *G. campestris* is much broader at the base of the leaf.

I have a specimen of the original gathering of *G. Bellii* in my herbarium, and it is identical with *G. campestris*.

4. **Grimmia trichophylla** Grev., Fl. Edinb., p. 235 (1824) ; Fl. N.Z., ii, 75 ; Handb. N.Z. Fl., p. 425.

Syn. *G. versabilis* R. Br. ter. in Trans. N.Z. Inst, vol. 27, p. 415. *G. finitima* R. Br. ter., *op. et loc. cit.* *G. flexifolia* R. Br. ter. (*non* Hampe), *op. cit.*, p. 417. *G. Cockaynei* R. Br. ter., *op. cit.*, p. 418. *G. Petriei* R. Br. ter., *op. et loc. cit.* *G. Stevensii* R. Br. ter., *op. et loc. cit.* *G. kaikouraensis* R. Br. ter., *op. cit.*, vol. 35, p. 337.

A frequent moss in New Zealand, and frequently fruiting, though dioicous. Most usually yellowish-green, and known by that and the narrow tapering leaves with linear basal cells from *G. pulvinata*, and indeed from all the species. The var. *nigra* R. Br. ter (Trans. N.Z. Inst., vol. 27, p. 415) appears to me a colour form only, and scarcely worth retaining.

Drummond's type of *G. cygnicolla* Tayl. is *G. pulvinata* var. *obtusa*, but Knight's specimens so named in Herb. Schimp. at Kew belong to *G. trichophylla*.

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* The enlarged drawings of this species by Brown in the Christchurch Museum show this feature very clearly, and also the small, entire, mitriform calyptra.

5. **Grimmia pulvinata** (L.) Sm., Eng. Bot., t. 1728 (1807) ; Handb. N.Z. Fl., p. 424. Var. **obtusa** (Brid.) Bry. Eur., fasc. 25–28, p. 12 (1845).

Syn. *G. pulvinata* var. *africana* H. f. & W., Fl. N.Z., ii, 75 (1855) ; Handb. N.Z. Fl., p. 425. *G. cygnicolla Tayl.* in Lond. Journ. Bot., V, 1G (1846). *G. rotunda* R. Br. ter. in Trans. N.Z. Inst. vol. 27, p. 416. *G. obovata* R. Br. ter., *op. et loc. cit.* *G. pusilla* R. Br. ter., *op. cit.*, p. 417. *G. webbii* R. Br. ter., *op. cit.*, p. 419. *G. Hutchinsonii* R. Br. ter., *op. cit.*, vol. 35, p. 337. *G. coarctata* C. M. in Hedwig., 37, 159. *G. micro-globosa* C. M., *op. cit.*, p. 160. *G. austro-pulvinata* C. M., *op. et loc. cit.*

Var. **basaltica** (Mitt.) Dixon comb. nov.

Syn. *G. basaltica* Mitt. in Hook. f., Handb. N.Z. Fl., p. 425.

I have seen no New Zealand specimens of *G. pulvinata* that I could refer to type (most belonging to var. *obtusa*), nor have I seen any records for this form ; the fact that Brotherus includes the above-cited three species of C. Mueller's under the synonymy of *G. pulvinata* by no means implies that they belong to the type ; the descriptions in fact make it clear that they belong to the variety.

G. basaltica Mitt. must, I feel confident, be referred here. It is described as differing from *G. orbicularis* in the more deeply ribbed capsule, with the peristome-teeth reflexed. The leaves in Mitten's specimens at Kew (under the name *G. reflexidens*),* coll. Lauder Lindsay, are identical with *G. pulvinata*. The peristome-teeth in mature capsules are in several cases strongly reflexed against the capsule-wall, though two or three capsules have them spreading and only slightly reflexed. In other respects the plant does not differ from *G. pulvinata*.

The position of the peristome-teeth in mature capsules is usually spreading almost horizontally. A specimen from Brown's herbarium, coll. W. Bell at foot of Lake Wakatipu, and labelled by Bell "*G. basaltica*," has the capsules deeply plicate, but the teeth horizontally spreading, not reflexed. In my own herbarium I have Scotch and Irish specimens of *G. pulvinata* with the teeth slightly reflexed, and in one tuft a single capsule has them strongly reflexed as in Mitten's *G. basaltica*, while the other capsules in the tuft are normal. *G. basaltica* must therefore be considered, I think, a variety only.

EXCLUDED SPECIES.

G. diminuta R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 417 = *Seligeria diminuta* (B. Br. ter.) Dixon comb. nov.

G. Buchanani Stirton = *Campylodontium lineare*.

G. Turneri R. Br. ter. in Trans. N.Z. Inst., vol. 35, p. 336 = *Ptychomitrium australe*.

G. Barrii R. Br. ter., *op. cit.*, p. 337=*Ptychomitrium Barrii*.

RHACOMITRIUM Brid., Mant., p. 78 (1819).

KEY TO THE SPECIES.

1.	Stems more or less prostrate. Leaves ending in a very long, denticulate, granulose hair-point	3. *hypnoides*.
	Stems more erect ; hair-points none or short	2
2.	Leaves deeply plicate	2. *ptychophyllum*.
	Leaves not plicate	1. *crispulum*.

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* Mitten no doubt altered his MS. name *reflexidens* to *basaltica* owing to the existence of *G. reflexidens* C. M. (1849).

1. **Rhacomitrium crispulum** (H. f. & W.) H. f. & W., Fl. Tasm., p. 181 (1867); Fl. N.Z., ii, 75; Handb. N.Z. Fl., p. 426.

Syn. *Dryptodon crispulus* H. f. & W., Fl. Antarct. i, 57 (1843). *Rhacomitrium convolutum* Mont. in Ann. Sc. Nat., iv, 122 (1845). *Grimmia symphyodonta* C. M., Syn., i, 809 (1849). *Rhacomitrium symphiodon* Mitt. in Fl. Tasm., ii, 181 (melius *symphyodontum*); Handb. N.Z. Fl., p. 426. *R. protensum* H. f. & W., Fl. N.Z., ii, 76; Handb. N.Z. Fl., p. 426 (*non* Braun). *Grimmia elegans* C. M. in Hedwig., 1898, p. 168. *G. helvola* C. M., *op. et loc. cit.* *Dryptodon chlorocarpus* Mitt. in F. v. Mueller's Fragm. phyt. austr., xi, p. 114. *Rhacomitrium chlorocarpum*, Par. Ind., ed. i.

Var. **rupestre** (H. f. & W.) Dixon comb. nov.

Syn. *Dryptodon rupestris* H. f. & W. in Lond. Journ. Bot., 1844, p. 544. *Rhacomitrium rupestre* H. f. & W., Fl. N.Z., ii, 65 (1855); Handb. N.Z. Fl., p. 426. *Grimmia nigrita* C. M., Syn., i, 801. *Rhacomitrium nigritum* Jaeg., Adumbr., i, 368.

The plants of this specific type are very difficult to unravel. There is a remarkable parallelism between them and the various forms of *R. heterostichum*, including *R. affine*, of the Northern Hemisphere, and they have led, like that, to the founding of numerous species, each presenting characters of some importance, but too closely intergrading to be satisfactorily regarded as specific. Like the northern plant, the stems may be fastigiately branched and almost without the short lateral branchlets characteristic of *Rhacomitrium*, or these may be well developed; the leaves may be elongate and subcrisped when dry, or short and closely imbricated; they may be erect or falcate; the margins widely recurved throughout, or very narrowly on one side only; the upper cells may be isodiametric or elongate (both forms occurring on the same stem); the apex may be longly or shortly hair-pointed or quite without hairs, and may then be acute or obtuse; the seta varies much in length, and the capsule also in size, shape, and colour.

For these reasons I am unable to see more than one specific type in the plants which have been described as species under the above synonymy. I have felt a slight hesitation about *R. rupestre*, and, as it appears at the least to be a very extreme form, and to have certain marked characters showing some constant correlation, I have retained it as a variety. Cardot (Fl. bryol. des Terres Magell., &c., p. 111) has described and figured a very striking feature in the areolation of this plant, which I have verified in a specimen from Kerguelen, in which the cell-walls of the basal areolation are punctulated with dots in longitudinal rows, which in the upper part of the leaf become laterally extended and confluent so as to form short horizontal plicae or furrows (are they not perhaps rather *thickenings* of the cell-wall?) crossing and obscuring the upper cells. I have made no study of the Antarctic plants in connection with this structure, but from Cardot's observations it would appear to be restricted to this particular form, and it gives an additional reason for treating it as distinct, varietally at least, from the ordinary forms of *R. crispulum*. The variety, apart from this character, is distinguished by its dark colour, densely imbricated shorter leaves, reddish capsule, long lid, and especially by the entire or nearly entire peristome-teeth. This latter character is no doubt the one on which authors have mainly relied in keeping *R. rupestre* distinct as a species from *R. crispulum*, some forms of which have the teeth divided to or nearly to the base into two filiform crura, while in the more usual case they are only partially and very irregularly split. But in *Rhacomitrium* this character is of the least possible value. The authors of the Bry. Europaea may well be quoted on this point in their notes on the peristome of *Rhacomitrium heterostichum:* "Peristomii dentes . . . bifidi, cruribus inaequalibus vel omnino liberis, vel irregulariter conglutinatis, haud raro fissis, nonnumquam toto longitudine integri aut solo apice bifidi." And a glance at their figures (tab. 265, 266) can hardly fail to convince even the most inveterate "splitter" that the form of the peristome-teeth is the last character on which species can be founded in this group.

Wilson's MS. notes in his herbarium show that he finally arrived at practically the same conclusions. He writes: "There is reason to conclude that all the New Zealand specimens (except a barren one in herb. Turner from Dickson called *Grimmia nigricans*, agreeing with *Dryptodon rupestris* from Hermite Island) are different states of one species." I have not been able to find this plant in Turner's herbarium; I presume it to be the var. *rupestre*, which appears to me to be the extreme form of the species reached under frigid and exposed conditions.

This var. *rupestre* is exceedingly rare in New Zealand. Colenso's plants so named in Hooker's herbarium are forms of *R. crispulum* merely, lacking the distinctive characters, such as they are, of var. *rupestre*. A single sterile plant, however, "H. 2646 *Bryum ater*, New Zealand. *Dryptodon rupestris* H. f. & W.," det. Mitten, is the correct plant, not only having the colour and foliation, but the leaves also exhibiting the peculiar transverse striolations described by Cardot.

A plant in R. Brown's herbarium from Stewart Island, comes very near the variety, and perhaps should be included under it. It has a very rigid habit, the leaves rigidly erect or erecto-patent, both moist and dry; the capsule is reddish, the lid long-beaked, the peristome-teeth while long and narrow are scarcely divided, mostly only marked by a narrow pellucid median line, along which they scarcely or rarely split; the basal cell-walls are seriately punctulate, but the upper cells have not the transverse striolations described above; and the seta is exceptionally short, shorter in fact than the capsule. It is obviously therefore extremely near to the variety.

R. heterostichum (Hedw.) is cited by various authorities from Tasmania and New Zealand, but I think under a misapprehension. At any rate, all the specimens I have seen so named from either Island belong to *R. crispulum*. The southern species differs appreciably from *R. heterostichum* (aggr.) in general habit, the very frequently yellowish colour (rarely the black hue that is so common in the northern plant), &c., but it is not easy to define any marked structural differences. A feature common to all the New Zealand specimens I have examined, in a more or less marked degree, and certainly less characteristic of *R. heterostichum* (though occasionally found there), is the structure of the basal angles of the leaf; these are more or less decurrent, and, while most of the cells remain practically unaltered to the point of insertion, a single row of marginal cells is markedly distinct, as they are hyaline, not sinuose, and the lowest one or two often considerably enlarged.

I have examined the *R. convolutum* Mont. from Chile, and it is certainly, as Mitten suggests, identical with *R. crispulum*. I have not seen the two species described as new by C. Mueller in Hedwig., 1898, but from the descriptions there can be no shadow of doubt that they belong here.

R. crispulum is distinguished from *R. ptychophyllum* at once by the leaves, which are not plicate, though when dry the strong carinate nerve may sometimes give this appearance; in any case they have not the numerous deep and narrow plicae of that species.

R. crispulum is widely distributed throughout the Subantarctic regions of both hemispheres. I have lately recorded it from several localities in South Africa.

The var. *crispulum* is recorded in the Handb. N.Z. Fl. from the North Island, coll. Colenso, but I have seen no specimens which I should refer to it in the collections at Kew and the British Museum. The Stewart Island plant referred to above is the nearest approach I have seen; but I suspect it may be found on some of the higher mountains. There is, however, a specimen in Hooker's herb. "*Bryum ater*. New Zealand, H. 2646," determined by Mitten as *Dryptodon rupestris* H. f. & W., and I presume collected by Hooker, which is no doubt correct, even showing the characteristic transverse cell striolations. But the data as to locality are vague.

2. **Rhacomitrium ptychophyllum** Mitt. in Handb. N.Z. Fl., p. 426.

A fine species, like the most robust, yellowish forms of *R. crispulum*, but known at once by the numerous deep sharp plicae of the leaves, which are only shortly diaphanous at the tip.

I have it from both the North and South Islands, but it appears not to be common. It is endemic to New Zealand.

3. **Rhacomitrium hypnoides** (L.) Lindb. in Oefv. af K. Vet.-Akad. Foerh. 1866, p. 552.

Syn. *R. lanuginosum* (Ehrh.) Brid., Mant. M., p. 79 (1819); Fl. N.Z. ii, 76; Handb. N.Z. Fl., p. 427.

Var. **pruinosum** H. f. & W., Fl. N.Z., ii, 76 (1855); Handb. N.Z. Fl., p. 427.

Syn. *R. pruinosum* C. M. in Verh. d. K. K. zool. bot. Ges. in Wien, 1869, p. 224.

The variety, distinguished by the extremely hoary leaves with long spinulose-serrate hair-points, is the only form found in New Zealand; it does not occur in the Northern Hemisphere, where the typical form is one of the commonest alpine or subalpine and boreal mosses. Both forms, however, occur at the Cape of Good Hope, so that the geographical distribution can scarcely be taken as indicating a specific distinction.

EXCLUDED SPECIES.

R. protensum Braun, H. f., Handb. N.Z. Fl., p. 426.—All the specimens of this, as well as New Zealand specimens named *R. fasciculare* Brid., in Hooker's and Wilson's herbaria, belong to forms of *R. crispulum*.

ANOECTANGIUM (Hedw.), Bry. eur., fasc. 29–30, 1846.

Only one species has been recorded from New Zealand — viz., *A. compactum* Schwaegr. The distribution of *A. compactum* is, however, entirely within the Northern Hemisphere, and the New Zealand species is definitely though not widely distinct, and is here described as *A. Bellii* Broth.

Anoectangium Bellii Broth., MS. in sched. sp. nov.

A. compacto Schwaegr. affine; differt foliis multo angustioribus, linearibus vel lineari-lanceolatis, peracutis, et nervo dorso minute distincte scaberulo.

A densely tufted plant, compact and abundantly radiculose in the lower part, much resembling species of *Weisia* and *Gymnostomum*, but differing essentially in the lateral, not terminal, fruit. The New Zealand species is much like the European *A. compactum*, but differs clearly in the narrower very acute leaves, with a sharp point mostly formed by the excurrent or percurrent nerve, which is finely but distinctly scaberulous at back. The cells are rendered opaque, each one being crowned on both surfaces by 2–5 rather high papillae, only a very few at extreme base being elongate, smooth and pellucid. Margin plane. Perichaetial leaves abruptly and rigidly cuspidate from a sheathing base. Capsule gymnostomous.

Hab.—Mount Ida, alt. 3,500 ft., Otago, coll. D. Petrie, det. Brotherus; No. 669 in Herb. Beckett. Mr. Petrie also sent it me from Rangi Taipo, Westland, and I have it from Lake Wakatipu and Mount Torlesse. It is recorded in the Handb. N.Z. Fl. from Otago; it would appear not to have been found in the North Island.

AMPHIDIUM (Nees) Schimper emend. in Bry. eur. Consp. (1855).

Amphidium cyathicarpum (Mont.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 460 (1902).

Syn. *Zygodon cyathicarpus* Mont. in Ann. Sci. Nat. (1845), p. 106; Handb. N.Z. Fl., p. 434. *Z. integrifolius* C. M. & Beckett in Trans. N.Z. Inst., vol., 25, p. 292 (1892), et C. M. in Hedwig., vol. 37, p. 133. *Z. compactus* C. M., *op. cit.*, p. 134 (1898).

This genus (often known as *Amphoridium* Schimp.) differs from *Zygodon* in the guide-cells of the nerve being median, not basal, and in the very short seta and hardly exserted capsule, which is pachydermatous, and when dry wide-mouthed and urceolate, quite gymnostomous.

The single N.Z. species is a very widespread one in the subtropical belt, being found in Ecuador and Chile, in Equatorial Africa and South Africa, in Australia, and Tasmania.

It closely resembles *A. Mougeotii* (Bry. eur.) of the Northern Hemisphere, but is (usually at least) autoicous, and has extremely narrow, ligulate, flexuose leaves, which are either entire above or indistinctly notched, or sometimes quite markedly, remotely denticulate; very variable on the same specimen.

I have original gatherings of *Z. integrifolius* C. M. & Beck. (redescribed by C. M. in Hedwigia, vol. 37), ex herb. Beckett. It was supposed to differ from *A. cyathicarpum* in the entire leaves without hyaline basal cells, and C. Mueller adds that the seta is "campylopodiaceo-flexuoso." I find the leaves, however, in the original specimen quite distinctly toothed, the hyaline cells at base just as in *A. cyathicarpum ;* and the seta, while flexuose, by no means "campylopodiaceous." It is quite inseparable from *A. cyathicarpum*. *Z. compactus* C. M. is certainly the same thing, judging from the description, which agrees exactly with our species

ZYGODON Hook. & Tayl., Muscol. Brit., p. 70 (1818).

A genus of small mosses, mostly tufted and arboreal, less frequently rupestral, with ribbed capsules exserted on a more or less elongate seta. Peristome orthotrichoid — often, however, imperfect or wanting — and cucullate calyptra. The species are difficult to define not so much from a tendency to intergrade or because they are very variable, but because the differences are slight, and in some cases rest principally on inflorescence and on minute peristome differences. In the following key I have attempted, quite artifically, to distinguish them, but it is a genus in which a knowledge of the plants themselves is much the safest and easiest guide to their recognition.

There has been a good deal of confusion caused by duplication of specific names in this genus, which it may be of advantage to clear up at the commencement.

Beckett in Trans. N.Z. Inst., vol. 29, p. 441, describes and figures *Z. mucronatus* Broth. M.S., a plant which, however, Brotherus subsequently identified as having been already described *Z. minutus* C. M. & Hpe. in Linn., 1856, p. 211.

C. Mueller, in Hedwig., vol. 37, p. 136, described independently *Z. mucronatus* n. sp., which has nothing to do with the previous plant. This I have examined and find identical with *Z. anomalus* Doz. & Molk.

Paris has added to the confusion by the following reference :—

Z. mucronatus { Broth. — *Z. minutus.*
{ C. M. — *Z. submucronatus.*

On turning to *Z. submucronatus*, however, no such name is found. The explanation probably is that Paris considered the name *mucronatus* C. M. as invalid, being antedated by *Z. mucronatus* Broth., and proposed for it the name *Z. submucronatus* Par., which, however, slipped out from the later page. The identification of *Z. mucronatus* C. M., however, with *Z. anomalus* Doz. & Molk. renders Paris's proposed name unnecessary.

KEY TO THE SPECIES.

1.	Robust plants ; stems 1–3 cm. high (*Z. Menziesii* may be sought here)	2
	Small plants ; stems rarely 1 cm. high	4
2.	Leaves undulate at margins, seta about 1 cm., often more ; synoicous	1. *anomalus.*
	Leaves not undulate ; seta rarely 1 cm. ; autoicous or dioicous ..	3
3.	Outer peristome failing	2. *intermedius.*
	Peristome double	3. *Brownii.*
4.	Leaves obtuse and rounded	5. *obtusifolius.*
	Leaves acute (in *Z. subminutus* at times subobtuse)	5
5.	Nerve excurrent	7. *minutus.*
	Nerve percurrent	8. *subminutus.*
	Nerve ceasing below apex	6
6.	Moderately robust, peristome double	4. *Menziesii.*.
	Very minute, peristome O	6. *sulcatus.*

1. **Zygodon anomalus** Doz. & Molk., Musc. frond. Arch. ind., p. 22 (1844); Fl. Tasm., ii, p. 185 (1860).

Syn. *Z. Reinwardtii* H. f. & Wils., Fl. N.Z., ii, p. 81; Handb. N.Z. Fl., p. 434 (nec *Z. Reinwardtii* (Hornsch.) A. Br.). *Z. mucronatus* C. M. in Hedwig., vol. 37, p. 136 (nec *Z. mucronatus* Broth. e Beckett in Trans. N.Z. Inst., vol. 29, p. 441).

This is the species which has generally been known as *Z. Reinwardtii*, the plant of Java and Ceylon: that has the leaves spinulose-denticulate at apex, while in the New Zealand species the leaf-apex is either quite entire or with one or two indistinct notches, of quite a different character from the teeth of *Z. Reinwardtii*. It is described in the Fl. N.Z. as "var. β foliis minus dentatis subintegris," with the remark that the peristome is absent in this variety.

Z. anomalus has been considered by various authors as synonymous with *Z. Reinwardtii*, but Fleischer (Musci . . . von Buitenzorg, ii) retains both species as independent, and on the whole this seems the most satisfactory treatment. The differences are no doubt light, consisting almost entirely in the leaves toothed in *Z. Reinwardtii*, entire or nearly so in *Z. anomalus*, and the inflorescence polygamous (synoicous and dioicous) in the former, synoicous in the latter. The outer peristome exists in both.

All the New Zealand and Australian plants belong to *Z. anomalus*, as does also the New Guinea plant collected by Giulianetti. The plants are put by Brotherus in a section having outer peristome failing, inner of 16 cilia; but Fleischer describes the Javan *Z. Reinwardtii* and *Z. anomalus* as with rudimentary outer peristome.

C. Mueller described his *Z. mucronatus* as dioicous and gymnostomous; Brotherus points out, however that it is neither, and maintains it as a good species; but (if it is not considered a form or variety of *Z. Reinwardtii*) there is no doubt that it must be referred to *Z. anomalus*. I have examined original specimens ex herb. C. Mueller, and it is certainly the ordinary New Zealand *Z. anomalus*.

Brotherus, moreover, gives New Zealand and Tasmania as localities for *Z. Reinwardtii*; but this does not imply that he has seen toothed-leaved plants from these localities, only that he accepts the records of other writers under this name. I have seen no Australian plants with the definite spinulose toothing (*cf.* Plate IX, fig. 3*a*) of *Z. Reinwardtii*. If both forms occurred there side by side, as in Java, I should think it strong evidence that one was a derivative of the other only.

The nerve is sometimes described as excurrent and forming a mucro, but it appears to me to cease nearly always below the apex, and the fine mucro not to be formed by the nerve.

Z. anomalus is the most robust of the New Zealand species, and, being synoicous, is more frequently and abundantly fruiting than *Z. intermedius* and *Z. Brownii*. It is also known from these by the larger leaves with more or less waved margins. It is probably more or less distributed throughout New Zealand.

2. **Zygodon intermedius** B. & S., Bry. eur., iii, fasc. 4, p. 9; Fl. N.Z., ii, p. 80; Handb. N.Z. Fl., p. 434.

The commonest species in New Zealand, and with a very wide geographical area. It scarcely differs, moreover, from the European *Z. conoideus*. It occurs in Java (*Z. affinis* Doz. & Molk.), *fide* Lindberg. It is known from *Z. Brownii* by the peristome only, from the remaining species by the larger size and longer seta. *Z. Menziesii* has a double peristome, and is usually a terrestrial or rupestral species, forming denser tufts with shorter stems, closer foliation, the leaves closely spirally enrolled when dry, wider with broader points, &c. *Z. intermedius* is nearly always found on wood.

3. **Zygodon Brownii** Schwaegr., Suppl., iv, p. 317 (1842) ; Fl. N.Z., ii, p. 81 ; Handb. N.Z. Fl., p. 434.

Syn. *Z. gracilicaulis* C. M. in Hedwig., vol. 37, p. 135.

The Handbook gives some distinguishing characters in the leaves to separate this from *Z. intermedius*, as does Wilson in his herbarium notes, but I do not find them borne out by an examination of the specimens ; nor, indeed, do Wilson's notes and sketches support the characters given in the Handbook. The nerve is certainly not continuous and excurrent, as stated. The sole difference is to be found in the peristome ; in *Z. intermedius* there is an inner peristome only, of 8 cilia ; in *Z. Brownii* there is an outer peristome present, which, however, is "often rudimentary or irregular." I am strongly inclined to think that the two will have to be merged into one species. The outer peristome of *Z. Brownii* may be well developed, and in that case there is a distinctly greater difference between this form and that with the outer peristome rudimentary than there is between this and *Z. intermedius* with outer peristome wanting. I have not, however, had sufficient material of *Z. Brownii* under my eye to justify the reduction ; but I am confident that further study by New Zealand bryologists will ultimately result in its being made.

I have examined an original specimen of *Z. gracilicaulis* C. M. in Herb. C. Mueller, and find it absolutely identical, vegetatively, with *Z. intermedius* and *Z. Brownii*. C. Mueller describes it as not exhibiting peristome, but Brotherus places it in a section with double peristome ; this implies that he has detected a well-developed peristome, in which case it must be referred to *Z. Brownii* rather than to *Z. intermedius*.

4. **Zygodon Menziesii** (Schwaegr.) W. Arn., Dispos. M., p. 15 (1825) : Handb. N.Z. Fl., p. 435.

Syn. *Codonoblepharum Menziesii* Schwaegr., Suppl., ii, p. 142 (1624). *Zygodon Drummondii* Tayl. in Lond. Journ. Bot., 1847, p. 46 (*fide* Mitten). *Bryum oamaruense* R. Br. ter. in Trans. N.Z. Inst., vol. 31 (1899) p. 447.

Generally shorter and more caespitose than the preceding plants, and often at least terrestrial in habitat ; the stems very short with dense leaves which are closely spirally twisted when dry, in general ; the leaves are wider than in the preceding plants, less acutely pointed, with a considerably stouter, brownish nerve, and cells of a different character. In the previously enumerated species the cells are filled with the cell-contents and are strongly incrassate with pellucid cell-walls ; they are therefore opaque, but very distinct. In the present plant they are much less incrassate, and at the same time more free from cell-contents ; they are therefore less opaque, but on the other hand are less clearly defined. They are usually very regularly arranged in rows ascending obliquely from the nerve to the margin.

The seta is variable in length, but rarely if ever reaches a centimetre ; it is rather stouter than in *Z. intermedius*, and often flexuose ; the capsule is shorter and wider, with a distinct neck ; the peristome well developed.

double, with 16 internal processes, often connivent in the form of a cone; the lid very shortly beaked. It is probably fairly common.

R. Brown was curiously misled over his *Bryum oamaruense*. Both in his own herbarium and in the Christchurch collection it is represented by a pure gathering of the present plant.

5. **Zygodon obtusifolius** Hook., Musc. Exot., t. 159 (1820); Fl. N.Z., ii, 80; Handb. N.Z. Fl., p. 434.

Syn. *Codonoblepharum neglectum* Jaeg., Adumbr., i, 396 (*nomen solum*). *Zygodon neglectus* Hampe & C. M. in Hedwig., vol. 37, p. 133.

Perhaps the most distinct of the New Zealand species, on account of the widely rounded, obtuse, lingulate leaves, the recurved margin, and pellucid nerve ceasing much below the apex, and scabrous at back. I have a specimen from "Nelson, N.Z., Dr. Grant," ex herb, Beckett, but I have seen no other records from the South Island. In the North Island it occurs on both trees and rocks.

The New Zealand plant was first recorded as *Z. obtusifolius* Hook., but of late years has been generally known as *Z. neglectus*. I have failed to ascertain any published ground for separating it from the Indian species. The name *neglectus* as a valid publication rests upon C. Mueller's description in Hedwig., vol. 37, p. 133. There he describes it without reference to *Z. obtusifolius*, and indeed without reference to the New Zealand plants recorded under that name in the Handb. N.Z. Fl., &c. He bases it on a specimen "*Z. neglectus* Hpe. in sched. 1868; Nova Seelandia, sine loco natali; Knight." The characters he gives are entirely consonant with *Z. obtusifolius* Hook., except that he describes the peristome as single. The New Zealand plant, however, has the peristome constantly double, and there is no reason to suspect that this particular specimen differs in that respect from the ordinary plants.

I have examined Hampe's herbarium to see if that author throws any light on the question; the only specimen of *Z. neglectus* there is a New Zealand plant without collector's name, on the label of which Hampe has written "*Z. neglectus* Hpe.," and underneath "*Z. obtusifolius* H. f. & W." There are no notes suggesting any difference from the Indian plant. It is not even certain that Hampe originally intended to separate it; he may have written the name *Z. neglectus* before recognizing that it was already known as *Z. obtusifolius*. I have carefully compared the New Zealand species with the Indian *Z. obtusifolius* (orig. leg. Wallich), and find no difference whatever. I have therefore retained the original name.

6. **Zygodon sulcatus** (Knight) Dixon, comb. nov.

Syn. *Gymnostomum sulcatum* Knight in Trans. N.Z. Inst., vol. 7, p. 355 (1874). *Zygodon nanus* C. M. in Hedwig. vol. 37, p. 135 (1898).

No specimens of *Gym. sulcatum* Knight have been available, but from Knight's description and figures in the Trans. N.Z. Inst. there can be no doubt whatever that it is identical with the plant described by C. Mueller as *Z. nanus*. This species, the type of which, by the courtesy of the authorities of the Berlin Museum, I have examined, has stems only 2–5 mm. high, with the leaves widely patent and recurved when moist, shortly tapering and acute, very carinate-concave with the stout pellucid nerve (not "perangusta," as C. Mueller describes it), which ceases well below the apex; cells small, rather obscure, scarcely elongate below; margin plane or nearly so; seta 4–5 mm. long, capsule oval, without any distinct neck, at least in the operculate stage, pale brown with a dark-purplish obliquely rostrate lid. Peristome O. Calyptra small.

It is quite distinct in the small size, minute leaves with nerve ceasing well below the apex, and gymnostomous capsule.

Hab.—No locality whatever beyond "New Zealand" is given by Knight. Greymouth; *leg.* Helms, in herb. C. Mueller.

R. Brown in Trans. N.Z. Inst., vol. 26, p. 287, it may be recalled, arrived at the same conclusion as to the generic position of *Z. sulcatus* Knight.

7. **Zygodon minutus** C. M. & Hpe. in Linn., 1856, p. 211.

Syn. *Z. mucronatus* Broth. *e* Beckett in Trans. N.Z. Inst., vol. 29, p. 441 (nec *Z. mucronatus* C. N. in Hedwig., vol. 37, p. 136).

A very small, densely tufted plant, with abundant fruit, on setae only a few millimetres in length; leaves elliptic-lanceolate, narrowed at base and tapering to a narrow, acute point, with the nerve generally excurrent in a sharp mucro, the cells rather large, distinct, and nearly all somewhat elongate not isodiametric smooth or nearly so, lax at extreme base; nerve rather stout, carinate, smooth at back.

The cell-structure and the excurrent nerve will distinguish it from *Z. sulcatus* (Knight).

Gathered in Auckland by D. Petrie, det. Brotherus. I have also a specimen labelled "N.Z. Travers" ex herb. Mitten. I do not know of any other records: the original gathering was made by F. Mueller in Australia.

8. **Zygodon subminutus** Broth. MS. in sched. sp. nov. (Plate IX, fig. 2.)

Tenellus, caespitans, pallidus: caules *graciles, molles*, vix 0·5 cm. alti, dense radiculosi, flexuosi surculis parvifoliis saepe intermixtis. Folia *minuta, oblongo-lanceolata, acuta vel subacuta*, rarius subobtusa, *perpellucida*, marginibus planis vel leniter recurvis, integris: costa *valida, subpellucida, saepe flavida, ante apicem soluta, laevis*. Cellulae *pellucidae*, plerumque inanes, *irregulares* (quadratae, subquadratae, rhomboideae, ovales), incrassatae, laeves, ad basin minime mutatae. ? Dioicus. Seta 3–4 mm., gracilis, theca *perminuta, ovalis, collo distincto nullo*, sicca plicata, operculo oblique rostellato, calyptra parva; spori minuti. Peristomium ? simplex (imperfectum) e membrana distincta alta, laevis, pellucida, articulata oriens.

Hab.—Thames, Auckland, July, 1896; leg. D. Petrie, det. Brotherus, No. 731. Comm. D. Petrie.

A very distinct little species with highly pellucid leaves more resembling *Anoectangium*. I have not been able to determine the inflorescence satisfactorily; it is probably dioicous, the male stems being mixed with the fertile ones.

EXCLUDED SPECIES.

Z. cyathicarpus Mont. = *Amphidium*.
Z. integrifolius C. M. & Beck. = *Amphidium cyathicarpum* (Mont). Broth.
Z. compactus C. M. = *Amphidium cyathicarpum* (Mont.) Broth.

ORTHOTRICHUM Hedwig, Descr. musc., ii, p. 96 (1789).

No genus of New Zealand mosses, perhaps, presents more difficulties than *Orthotrichum*. The plants themselves present problems sufficiently troublesome, but these have been aggravated by their treatment by bryologists. In vol. 27 (1894) of the Trans. N.Z. Inst., pp. 422–43, pl. xxxv–xliii, R. Brown has described and figured forty new species. In his introductory remarks he admits that though he has been unable to identify any of his plants with already described species, it is possible that some of them may be identical, but he has "therefore treated the whole of the plants collected by me as new species, with the exception of *O. graphiomitrium*." Unfortunately, partly owing to the inadequacy of the figures, and partly owing to the fact that the systematic arrangement of the genus depends very greatly on characters not recognized in Brown's time, it is quite impossible to form any sound opinion as to the plants represented by his descriptions. Happily his herbarium contains thirty-six out of the forty described species, and in the case of the missing species the descriptions and figures afford sufficient evidence to enable them all to be recognized without doubt as identical with one or other of the already described species. The four species described in the Trans. N.Z. Inst., vol. 35, pp. 332–3, are unrepresented in Brown's herbarium, but fortunately in three cases the descriptions leave practically no doubt, and in the fourth very little, of their identity with already published species.

R. Brown based his arrangement upon two characters—the presence or absence of an inner peristome, and the hairiness or otherwise of the calyptra. Both are of importance, but the former is apt to be deceptive, since the inner peristome is often very fragile and fugitive, and its actual absence can only be safely presumed when the fruit is in good and not overmature condition. Unfortunately in several of Brown's gatherings this is not the case, and he has been more than once misled into separating plants as with "peristome single" owing to the destruction through age of the inner processes.

His notes on the distribution and ecology of the genus are interesting and valuable.

The result of my examination of Brown's specimens is that the forty-four species described as new must be reduced to eight. Of these, five had already been published under other names, leaving the remaining three names to stand; two of these three are published under more than one name by Brown, and in these cases I have taken the earliest published. These three names are—

O. cyathiforme R. Br. ter. = *O. pseudo-pumilum* Vent.
O. pulvinatum R. Br. ter. = O. *rupestriforme* Vent.
O. lancifolium R. Br. ter. = *O. rufidens* Vent. ined.

It may be convenient here to give a summary of my reductions :—

Species.		Synonyms.
O. calvum H. f. & W.	..	*O. avonense*, *O. minutum*.
O. graphionitrium C. M.	..	*O. acuminatum*, *O. obesum*.
O. pulvinatum R. Br. ter.	..	*O. calcareum*, *O. fimbriatum*, *O. oamaruanum*, *O. oamaruense*, *O. reflexum*.
O. tasmanicum H. f. & W.	..	*O. clintonii*, *O. curvatum*, *O. cylindrothecum*, *O. nudum*, *O. subulatum*.
O. Beckettii C. M.	..	*O. inaequale*, *O. parvithecum*, *O. conicorostrum*. *O. obliquum*.
O. hortense Bosw.	..	*O. benmorense*, *O. breve*, *O. brevisetum*, *O. longithecum*, *O. magnothecum*, *O. minimifolium*.
O. cyathiforme R. Br. ter.	..	*O. brevirostrum*, *O. arctum*, *O. latifolium*.
Ulota lutea Mitt.	..	*O. flexifolium*, *O. gracillimum*, *O. otiraense*, *O. parvulum*, *O. tortulosum*, *O. erectum*.

I have based the following arrangement principally upon my own study of the plants themselves. Mr. W. Gray, of Mauriceville, has for some years furnished me with ample collections, mostly of the smaller species; while Dr. Brotherus has kindly put at my disposal his rich collection, mostly collected by the late W. Bell; and I have a good many of Beckett's collecting, for which I am indebted to the Rev. C. H. Binstead and Mr. D. Petrie. So far as these specimens go (and they number some hundreds) they do not at all bear out Brown's conclusions as to the large number of New Zealand species, and there is no doubt that he relied too much on characters which cannot be held of specific value.

Certain characters which have been used as the basis of specific descriptions are of less value than formerly supposed. The length of the seta and the degree of exsertion of the capsule has its value, but may easily be overrated. The colour of the calyptra, and to some degree its hairiness or otherwise, are also liable to lead to error if too implicitly relied on, as is also the degree of striation of the capsule in certain species. Among the most reliable characters are the stomata on the capsule-wall, the form of the exothecium cells, and the minute structure of the peristome.

The structure of the capsular stomata is of first importance. In one group (Gymnoporus) these are superficial, lying between and practically flush with the outer layer of exothecium cells; the stomata are therfore fully exposed to view. In the other group (Calyptoporus) the stomata lie below the outer layer, and are more or less covered by a ring of surrounding exothecium cells, which are not flat as usual, but are protuberant above the level of the capsule-wall; in this case the guard-cells of the stomata are almost or quite concealed. The stoma in the immersed form may be compared to a minute volcano, with the guard-cells and stoma lying at the bottom of the crater (*cf.* Plate IX, figs. 5 and 6).

The terms "immersed" and "exserted," of the capsule, are frequently rather loosely used. I have endeavoured to employ them with a greater degree of precision, as they are of considerable importance, as follows:—

Immersed, when the upper leaves (when moist) reach to or very nearly to the top of the capsule.

Emergent, when they reach above the base but not nearly to the top of the capsule.

Exserted, when they reach approximately to the base of the capsule.

Fully exserted, when the capsule base is well above the upper leaves.

As a rule the capsules appear more exserted in the dry state than when moist, owing to the leaves being somewhat twisted and therefore less erect; but this is not always the case.

I have used the term "processes" for the teeth of the inner peristome, rather than "cilia," the term in frequent use, as they are by no means homologous with the cilia of the Bryoid and Hypnoid peristome, but rather with the processes, being alternate with the outer teeth. These processes are often very delicate and fragile, and the peristome must not be too hastily assumed to be single simply because they are not easily found. On the other hand, it happens that in several of the New Zealand species the processes are unusually broad as compared with those of most of the European species.

The species may perhaps be conveniently grouped as follows, with reference, for the most part, to their affinity with or resemblance to certain well-known European species :—

I. CALYPTOPORUS.

a. Crassifolia. Leaves bi-stratose ; peristome single. (These two species, not found on the main Islands, have been placed in a separate genus, *Muelleriella*, by Dixon, in Botan. Notes, 1905, p. 304.)
O. crassifolium ; O. angustifolium.

b. Puchelloid habit. Calyptra naked.
O. calvum.

II. GYMNOPORUS.

c. Puchella. Small plants ; capsule fully exserted.
O. lancifolium ; O. austro-pulchellum.

d. Affinia. Small to medium-sized plants ; capsule immersed or emergent.
O. hortense ; O. cyathiforme.

e. Leiocarpa. Robust ; capsule immersed, smooth.
O. graphiometrium.

f. Speciosa. Robust ; capsule exserted, smooth.
O. Beckettii.

g. Ulotoidea. Medium-sized ; capsule longly exserted, ribbed ; leaves Ulotoid.
O. tasmanicum.

h. Rupestria. Robust ; rock-plants ; capsule urceolate, emergent, peristome-teeth erect when dry ; like *O. rupestre* Schleich.
O. pulvinatum ; O. praeperistomatum.

KEY TO THE SPECIES.

CALYPTOPORUS. Stomata immersed.

1.	Lamina of leaf bistratose ; peristome single, rupestral ..	2
	Lamina unistratose ; peristome double ; calyptra naked : capsule minute, fully exserted	3. *O. calvum.*
2.	Leaves acuminate	1. *O. angustifolium.*
	Leaves obtuse	2. *O. crassifolium.*

GYMNOPORUS. Stomata superficial.

3.	Plants small	4
	Plants robust	7
4.	Leaves obtuse ; capsule immersed or emergent ; calyptra naked, pale	10. *O. cyathiforme.*
	Leaves more or less acute ; calyptra mostly hairy ..	5
5.	Capsule emergent, ribbed ; leaves acute, variable in size	8. *O. hortense.*
	Capsule fully exserted, very small	6
6.	Capsule smooth or faintly ribbed ; peristome usually red ; teeth densely but not highly papillose	4. *O. lancifolium.*
	Capsule strongly ribbed ; peristome brown ; teeth densely, highly papillose, subciliolate at margins ..	5. *O. austro-pulchellum.*
7.	Capsule not exserted, immersed or emergent	8
	Capsule exserted	10
8.	Arboreal ; capsule smooth, thin-walled ; calyptra hairy ; teeth reflexed when dry	9. *O. graphiomitrium.*
	Rupestral ; capsule ribbed ; calyptra very hairy ; leaves often hyaline-tipped ; peristome-teeth erect when dry	9
9.	Praeperistome usually present ; teeth smooth or almost so	12. *O. praeperistomatum.*
	Praeperistome wanting ; teeth densely, finely papillose ..	11. *O. pulvinatum.*
10.	Capsule ribbed, single ; seta quite equal to capsule ; calyptra mostly hairy	6. *O. tasmanicum.*
	Capsules often in pairs, almost smooth ; seta shorter ; calyptra naked or nearly so	7. *O. Beckettii.*

Subgen. I. Calyptoporus. Stomata immersed.

1. **Orthotrichum angustifolium** H. f. & W. in Lond. Journ. Bot., 1844, p. 547; Fl. Antarct. i, p. 125; Handb. N.Z. Fl., p. 433.

This and the following species are distinguished by the solid bistratose upper part of the leaf-lamina. Both are dense, blackish plants, the present with extremely narrow, finely acuminate leaves, almost Blindioid in appearance. It is only known from Campbell Island and Kerguelen.

2. **Orthotrichum crassifolium** H. f. & W. in Lond. Journ. Bot., 1844, p. 546; Handb. N.Z. Fl., p. 433.

A similar plant to the last, and, like it, growing on rocks; but with the leaves much broader above, and subobtuse. The capsule is exserted or very nearly so, and smooth, the calyptra glabrous. It has a somewhat wider distribution, but in the New Zealand area is found only in the Lord Auckland and Campbell Islands.

3. **Orthotrichum calvum** H. f. & W., Fl. N.Z., ii, 8 (1855); Handb. N.Z. Fl., p. 432.

Syn. *O. avonense* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 438.
O minutum R. Br. ter., *op. cit.*, p. 437.

Orthotrichum pulchellum Brunt. and a few allied species form a very distinct group in the Northern Hemisphere; they are small mosses, usually in very small tufts, with leaves frequently crisped when dry, the capsule very small, clearly exserted on a seta as long as or longer than the capsule itself, the peristome red or pale. There are several New Zealand species of the same habit and appearance, which I have been able to study with some minuteness from recent material collected by Mr. W. Gray. It soon became obvious that more than one species existed, and, as many of the plants were very puzzling, it became necessary to establish first of all which of them was *O. calvum* H. f. & W. Several of the species have the stomata superficial, and *O. calvum* is placed by Brotherus among these. Examination of Wilson's type at the British Museum, however, established the fact that it is calyptoporous, and therefore removed from the other New Zealand plants of similar habit.

Wilson's material is extremely scanty, nor does Hooker's herbarium at Kew do much to supplement it, in fact, the whole material might easily be piled on a postage-stamp! That in Wilson's herbarium consists of two plants collected by Colenso—viz., Col. 817 and Col. 484c. Col. 817 has very young capsules and no peristome, and half a dozen young calyptras, all naked. Col. 484c has two or three mature, deoperculate capsules without calyptra. Attached to this is the following note by Wilson: "*Orthotr. calvum.* H. f. & W.? (compared with Col. 817)—Calypt. pale below, reddish at apex, slightly hairy, teeth reddish-buff, reflexed when dry. Cilia 8, white, narrow, vaginula hairy: capsula sicca striata." It would appear from this that Wilson considered Col. 817 as the type of the species; on the other hand, the description of the peristome must certainly be taken from Col. 484c. The question arises whether the calyptra is sometimes hairy, as mentioned by Wilson. Now, there is no calyptra to be found in either Wilson's or Hooker's specimen of Col. 484c; nor are the capsules at such a stage that calyptras could have been attached. If Wilson observed a hairy calyptra, therefore, it must have been unattached, and may therefore have come from another species. I have examined many hundreds of calyptras of *O. calvum*, and have never seen a pilose one; I think there is no doubt, therefore, that Wilson's remark may be neglected. In any case he finally wrote up Col. 484c as "*O. calvum*," and in the description in Fl. N.Z. the calyptra is described simply as naked.

In all other respects Col. 817 and Col. 484c agree, and from the two combined a good idea may be obtained of the essential characters of the species in its typical form. Having grasped these I had no difficulty in recognizing it among Mr. Gray's specimens, and am able therefore to supplement the published description from freshly gathered material. The leaves are small, narrow, lingulate, subacute or almost obtuse, rarely narrowed to a really acute point, very slightly crisped when dry; the cells small and but little papillose, the margin plane above, usually slightly recurved below. The capsule is small, usually passing rather abruptly into the seta when moist, and at the time of maturity, but like most species tapering much more gradually at base when overmature and in the dry state; the seta is considerably longer than the capsule, which is fully exserted far above the leaves. The vaginula is markedly hairy. The capsule is constricted below the mouth when dry, markedly and rather strongly ribbed; the calyptra is usually pale brown at the base, bright red-brown at apex, usually somewhat lobed at base when fully expanded and fallen. The stomata are immersed, the overlapping cells almost meeting one another, so as to leave only a small irregular aperture. They are usually to be found about the base of the spore-sac—that is to say, rather below the middle of the capsule. The exothecium cells are very regularly and shortly rectangular or quadrate, in longitudinal series, those on the ribs with rather incrassate walls, those in the furrows thinner walled. The peristome is pure-white at the fall of the lid, the teeth 16, united in pairs, densely and rather finely papillose with a tendency to vertical striation, the median and dividing [vertical] lines pellucid, the inner plate of the teeth being thinned or even absorbed along these lines; the processes 8, delicately filiform, smooth and hyaline. The outer peristome-teeth are erect or spreading at the fall of the lid, becoming finally—after moistening and drying again—reflexed, so as to lie flat against the wall of the capsule. When old they become brownish. Spores about 20μ.

I have described these structures at some length, as they will enable the allied or similar species to be characterized more simply by comparison.

O. calvum, however, varies in some directions to a somewhat surprising extent, and I found it at first difficult to resist the conviction that several distinct species were involved; the presence, however, of intermediate forms on the one hand, or on the other the restrictions of the variation to a single character, unaccompanied by any further deviation, have convinced me that this cannot be maintained.

(*a*.) The calyptra may be quite pale, greenish-white, with only a slightly brown point. Intermediate forms occur.

(*b*.) The outer teeth may show a pronounced tendency to a red or brown colour. This I have rarely observed, and various shades of colour were seen in different capsules on the same tuft, all in the same stage. The processes share in the alteration of the colouring.

(*c*.) The length of the seta varies to a remarkable extent. One particular form has all the appearance, at first, of a different species. Here the seta is very short, much shorter than the capsule, which is scarcely exserted. The capsule is small, very much constricted both at and below the mouth.

The vaginula is in this form clothed with a dense mass of pure-white hairs, conspicuous under the lens; and there is in addition a very highly developed ochrea, forming a white sheath reaching often to the base of the capsule itself. These characters appear to be constant throughout a given tuft, though the development of the ochrea may vary somewhat. These plants have, in short, all the appearance of a distinct species.

But side by side with these occurs a plant similar in all respects but without any development of the ochrea, and with the vaginula only normally hairy; and, further, forms occur which only differ from the type in having the seta decidedly shorter than usual, so that the capsule is scarcely exserted, but in other ways departing in no wise from the type. Moreover, I have seen plants with the normally exserted capsule, but showing here and there a distinct, elongate ochrea. I feel bound, therefore, to unite all these under *O. calvum*, but I think the short-setaed plant with small, much constricted capsule may fairly be described as a variety. It is partly, no doubt, this variability in *O. calvum* that has led Brown to the creation of the two new species placed above in the synonymy.

Var. nov. **brevisetum** Dixon. *Seta perbrevis*, multo brevior quam theca. Theca *parva, sicca apud et infra orificium valde coarctata*; vaginula plerumque pilosissima; ochrea saepe bene evoluta, albida, elongata, setam vaginans.

Hab. On willows, Mauriceville, Wairarapa, Dec., 1909; *leg.* W. Gray (No. 6). Also from several other spots in the same locality.

The species may be a fairly distributed one, but, as in the case of most species of the genus, I have only scanty data to go upon. None of the species are at all well represented in our national collections, yet it would not seem likely that they are all rare. Indeed, from the material I have received from Mr. Gray, Mr. Petrie, and others I should judge the contrary to be the case; but the localities are too restricted to enable any fair idea to be formed of the general distribution.

Subgen. II. GYMNOPORUS. Stomata superficial.

4. **Orthotrichum lancifolium** R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 429.

Syn. *O. rufidens* Vent., MS., in sched.

This species is notable for the very beautiful rose-red colour of the peristome-teeth, when typically exhibited, and in some respects it is a pity that the name cannot be retained; but Brown's type of *O. lancifolium* is undoubtedly the same thing. The justification for including Venturi's MS. name in the synonymy is that the plant has long been distributed and known under that name.

It may be of some use to give here the description which I had drawn up for publication before I had seen Brown's plant and recognized that it was an already published species:—

Maxime variabile; sat gracile, flavo-viride, infra rufescens. Caulis circa 1 mm. altus, fastigiate ramosus; folia *elongata*, sicca flexuosa vel paullo crispata, *angusta*, acuta, papillosa. Vaginula parcissime pilosa. Theca *bene exserta*, seta aequilonga vel duplo longiore; maturitate viridis, aetate subaurantiaca, *leptodermica, estriata vel infra orificium leniter striata*, raro per totam longitudinem leniter plicata, oblonga vel oblongo-cylindrica, infra orificium *parum constricta*; calyptra parce pilosa.* Exothecii cellulae

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* In the descriptions of the form of the capsule I refer to it, unless otherwise mentioned, in the dry condition.

irregulariter rectangulares, elongatae, parietibus sat firmis nec multo incrassatis. Stomata pauca, circa mediam thecam. Peristomium duplex, dentes externi *pulcherrime rosei*, dense *nec alte* papillosi, plus minusve longitudinaliter striolati, sicci eleganter recurvi nec reflexi; processus 8, albidi vel rufi, *perlati*, parce papillosi, *linea media valde angulata*. Spori magni, 20–24μ.

This is a well-marked species, especially in its typical condition, remarkable for its very beautiful rosy red outer peristome, and broad pink or white processes. It is, however, an exceedingly difficult plant to define, being extremely variable in size, foliation, and fruit. The capsules may be short and wide, or elongate and cylindric, perfectly smooth or occasionally quite deeply plicate; the vaginula may be quite smooth or moderately hairy; and, finally, the peristome may be quite pale, even a dirty white. The hairiness of the calyptra also varies somewhat, but it is usually not very densely clothed. As a rule, however, when this occurs, some capsules will show a trace at least of the red colour. The outer teeth (at least, until the capsule is very old) are not reflexed so as to lie flat on the capsule-wall, but gracefully recurved so as to touch the wall with the tips only, when dry. The peristome and the leptodermatous, usually smooth capsule will serve to distinguish it easily from all species but *O. Beckettii* and *O. tasmanicum*. The former is a taller, much more robust plant, the capsules usually in pairs, paler and less brightly coloured, with pale, not red peristome. *O. tasmanicum* has forms which are puzzingly like *O. lancifolium*: in its normal forms it is taller, more robust, with larger, longer, deeply plicate capsule and pale peristome; but certain small forms occur with reddish peristome and small, smoother capsules which I am quite unable to separate except by the processes of the inner peristome, which in *O. tasmanicum* appear not to have the zigzag median line which is so strongly marked here; it is, on the contrary, straight, or may be wanting, only half of the process being developed. The leaves of *O. lancifolium*, like those of *O. tasmanicum*, moreover, are markedly Ulotoid in form and areolation like those of *O. tasmanicum*, though less markedly crisped when dry. It is no doubt forms of this species that Venturi (Rev. bryol., 1896, p. 65) found so perplexing in their relationship to *O. tasmanicum*, and it is quite possible that the two species may ultimately have to be united.

For the difference from *O. austro-pulchellum* see below.

5. Orthotrichum austro-pulchellum C. M. in Hedwig., xxxvii, 139 (1898).

This is a very doubtful plant. C. Mueller's description is insufficient for a species of such a critical genus; he describes the peristome as single, the outer teeth as "*glaberrimi*"; which seems improbable, especially as they are "*aurantiaci*." Moreover, a capsule of the original plant, collected by Beckett, and sent me by Brotherus, with the teeth orange-red, shows their dorsal surface very densely and highly papillose, and similarly with the ventral surface; the papillae on the inner face being in vertical lines, on the outer horizontal or spreading in a fan-like direction, projecting strongly at the sides of the tooth, which are therefore fringed when viewed under a high power. There is also a part of a single process remaining, broad, transversely articulate without a median line, and coloured. In other respects the plant appears to be inseparable from *O. lancifolium*. It is obviously unsatisfactory to separate this species from the preceding one solely by a character which is diametrically at variance with the author's description; but if this character be not maintained there is nothing whatever, either in the plant itself or in the description, to warrant its separation from *O. lancifolium*. It is quite possible that it may simply be that, and that the capsule I have examined may be an abnormal one in the peristome; but the matter can hardly be cleared up except by further examination of the type material or by rediscovery of the plant in the field.

The original plant was gathered on Banks Peninsula.

6. **Orthotrichum tasmanicum** H. f. & W. in Journ. Bot., 1848, p. 27; Fl. Tasm., ii, 184.

Syn. *O. laticiliatum** Vent. & Broth. in Oefv. af Finska Vet. Soc. Foerh., xxxv, 44 (1893). *O. Clintonii* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 429. *O. curvatum* R. Br. ter., *op. cit.*, p. 442. *O. cylindrothecum* R. Br. ter., *op. cit.*, p. 432. *O. nudum* R. Br. ter., *op. cit.*, p. 438. *O. subulatum* R. Br. ter., *op. cit.*, p. 441.

Plants usually in rather dense tufts, with the leaves often somewhat crisped when dry, and the ribbed capsule conspicuously exserted on a long seta.

A rather variable plant in size, &c., as mentioned under *O. lancifolium*, and having the calyptra either quite glabrous or somewhat hairy on the same tuft; but fairly well distinguishable by the longly exserted capsule, and from the taller allied plants by the striate theca and compact tufts; from the smaller Pulchelloid species by its larger size; the broad processes and the pale colour of the outer teeth are also strong characters, as well as the form and structure of the leaves. The vaginula is hairy.

It is perhaps more difficult to separate from *Ulota lutea* than from any of the species of its own genus; in fact, the larger size, wider and less crisped leaves, and less densely hairy calyptra are almost the sole distinguishing characters. The leaves have entirely the form and structure of *Ulota*, but the stomata are scattered on the surface of the theca, and not confined to the neck, and this seems definitely to relegate it to *Orthotrichum*, otherwise the crucial distinction between the genera disappears. If hybridization were a more frequent phenomenon in the Bryophytes, one would be tempted to suggest that *O. tasmanicum* might be the product of fertilization of *Ulota lutea* by *O. lancifolium*.

I have compared *O. lateciliatum* (original specimen, New Town Rivulet, Tasmania, ex herb. Weymouth) with *O. tasmanicum*, and though at first sight it appears to be a more robust plant than the ordinary forms of *O. tasmanicum*, this is not borne out by closer examination; and the abundant material of Gunn's No. 1629 in Herb. Wils., the type of *O. tasmanicum*, is absolutely identical in habit and other characters with Venturi's plant. Venturi probably only had the smaller forms of *O. tasmanicum* with less striate capsules to compare.

O. tasmanicum would seem to be a widely distributed species.

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* Published as *O. lateciliatum*, but Paris's orthography would appear to be more correct.

7. **Orthotrichum Beckettii** C. M. in Hedwig., xxxvii, 139 (1898).

Syn. *O. conicorostrum* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 425. *O. obliquum* R. Br. ter., *op. cit.*, p. 428. *O. inaequale* R. Br. ter., *op. cit.*, 429. *O. parvithecum* R. Br. ter., *op. cit.*, p. 440.

Beckett in Trans. N.Z. Inst., vol. 26, p. 277, refers to this as being synonymous with *O. laticiliatum* Vent. & Broth.; but this is due to some misunderstanding. The two plants are quite distinct, and *O. Beckettii* is, to my mind, one of the most distinct, at any rate of the larger species.

I have part of the original gathering, ex herb. C. Mueller, by the kindness of Dr. Brotherus, and I have been able to identify it with numerous other specimens collected by Petrie and others, and thus form a clear conception of the species. It is a tall plant, reaching 3 cm. and more in height, the stems only slightly and shortly branched, the capsules persisting for several years and therefore appearing lateral on the stems and very numerous, especially as they are produced frequently, perhaps most commonly, two or even more from the same perichaetium. They are more or less distinctly exserted, but not so longly as in *O. tasmanicum*; they are smooth or very lightly striate only, leptodermous—the exothecium cells having very thin walls—the calyptra naked (rarely sparsely pilose). C. Mueller describes the processes as "8, capillares, hyalini"; but Petrie's specimens from Rangi Taipo, Westland, show them decidedly broad; they are pure-white, erect, while the outer ones are strongly recurved on to the capsule-wall.

C. Mueller describes the leaves as quite entire; but, while this is sometimes the case, they sometimes end in an erose-denticulate subhyaline point; they are much larger and longer than in the previously described species. C. Mueller compares it with *O. pulchellum*, a comparison which I am unable to follow; indeed, his description as "caespites unciales . . . surculus innovando pluries thecigerus" is entirely at variance with it.

It is, I should judge, a fairly well distributed species.

8. **Orthotrichum hortense** Bosw. in Journ. Bot., 1892, p. 97.

Syn. *O. breve* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 426. *O. benmorense* R. Br. ter., *op. cit.*, p. 430. *O. brevisetum* R. Br. ter., *op. cit.*, p. 434. *O. magnothecum* R. Br. ter., *op. cit.*, p. 435. *O. minimifolium* R. Br. ter., *op. cit.*, p. 439. *O. longithecum* R. Br. ter., *op. cit.*, p. 433.

Rev. C. H. Binstead has sent me part of the original gathering of this, collected by Mrs. Roper, determined by Boswell. The author compares it with *O. speciosum*, and describes the capsules as exserted; but this is a loose employment of the term. The capsules are variously emergent, but the base of the capsule is rarely if ever above the tips of the leaves, and the fruit is often half-immersed; the theca is also strongly plicate, and the resemblance to *O. speciosum* is not evident. Boswell, moreover, describes the peristome as red. In the original plant there is no trace of red, and the capsules are not at all exserted. I make no doubt that the above comparison and description is due to there having been a plant of *O. lancifolium* intermixed with the true *O. hortense*. Boswell also compares it with *O. affine*, and this is no doubt the true affinity of the species. It shows a good deal of variation, but is no doubt a good species, though without any very striking characters.

The half-emergent plicate capsule, pale and suburceolate at ripening, when empty narrow and brown, is the best guide to its identity. Small dense forms have the capsules sometimes immersed: in these cases it is extremely difficult to separate from *O. cyathiforme*, especially as in these cases the leaves are often subobtuse; but the hairy calyptra, if present, will at once distinguish it, while the leaves are in most forms much more acute than in that species. The calyptra is frequently, perhaps normally, smooth below and hairy only near the tip: it is usually pale below, and always reddish at the apex.

The exothecium cells are distinct in being arranged in very regular vertical rows, with the longitudinal walls strongly incrassate, while the transverse walls are very narrow and inconspicuous. The stomata are superficial. The peristome-teeth are pale on deoperculation, most frequently brown when fully mature; the processes filiform but rather stout, pale or brown, finely papillose.

O. hortense is probably one of the most common species; I have it from numerous localities in both Islands.

9. **Orthotrichum graphiomitrium** C. M. & Beckett in Trans. N.Z. Inst., vol. 25, p. 291, t. 36 (1892).

Syn. *O. leiolecythis* C. M. in Hedwig., xxxvii, p. 140 (1897). *O. subleiolecythis* Par. Ind. Suppl., p. 260. *O. acuminatum* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 434. *O. obesum* R. Br. ter., *op. cit.*, p. 435.

This species is at once distinguished from all the preceding by the quite immersed, smooth capsule, which is turgidly oblong-oval, narrower at the mouth, pale in colour, resembling that of the European *O. leiocarpum*. The plant is very robust, with large, long leaves, the calyptra more or less densely pilose, undulate-lobed at the base. The exothecium cells are very thin-walled, short and wide; the stomata in the upper or lower part of the capsule; the peristome pale, reflexed when dry, the processes broad, with a median line and irregular margins. The capsules persist for several years, becoming lateral, but, being immersed, are not conspicuous as in *O. Beckettii*. Beckett describes the habit as peculiar, the stems being prostrate and almost creeping, as in *Macromitrium*, so as to form large, wide patches.

From the description I think there can be no doubt that *O. leiolecythis* C. M. (nec *O. leiolecythis* C. M. in Nuov. Giorn. Bot. ital., 1896, p. 107) is to be referred here. C. Mueller's descriptions of the two species* do not suggest any character of importance beyond the calyptra densely hairy in *O. graphiomitrium*, sparsely hairy in *O. leiolecythis*. And he does not in his notes suggest any further difference beyond this calyptra character, and a flexuose stem in *O. graphiomitrium* as against a geniculate one in *O. leiolecythis*. I have seen no specimen of *O. leiolecythis*; but I have plants with the calyptra rather densely pilose, of which the stems are more or less geniculate, while a specimen collected by Mr. Petrie in Leith Valley, Dunedin, has the calyptra only sparsely pilose while the stems are not markedly geniculate.

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* Beckett published *O. graphiomitrium* in the Trans. N.Z. Inst. in 1892; in 1898 C. Mueller described it as new in Hedwigia, doubtless overlooking the previous publication.

10. **Orthotrichum cyathiforme** R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 436 (1894).

Syn. *O. brevirostrum* R. Br. ter., *op. cit.*, p. 437. *O. arctum* R. Br. ter., *op. cit.*, p. 440. *O. latifolium* R. Br. ter., *op. cit.*, p. 441. *O. pseudo-pumilum* Vent. in Rev. bryol., 1896, p. 67. *O. ligulatum* C. M. in Hedwig., xxxvi, 140 (1898). *O. pumilum* H. f. & W., Fl. N.Z., ii, 80, and Handb. N.Z. Fl., p. 432 (nec *O. pumilum* Dicks.).

Venturi has given a detailed description of this species in the *Revue Bryologique* as cited above, pointing out certain characters by which it differs slightly from the European *O. pumilum* Dicks., for which the authors of the Flora N.Z. took it. These characters are principally in the leaves, which in the European plant are more frequently acute, and often with a diaphanous apiculus: the New Zealand species has the leaves more often obtuse, generally decidedly so, and the apiculus when present is, according to Venturi, not diaphanous. Whether these differences are sufficient upon which to found a distinct species is perhaps somewhat doubtful, but the apparent absence of *O. pumilum* from other parts of the Southern Hemisphere affords some support to that view.

It is quite distinct from the other New Zealand species (except for some stunted forms of *O. hortense*, for which see above), forming small, low, dense cushions, with the leaves mostly very obtuse, erect or nearly so and closely imbricate when dry, the calyptra pale and quite smooth, the capsule immersed or partially emerging only, small, strongly ribbed when dry, with pale peristome-teeth, reflexed when dry, and eight filiform processes. Some of Venturi's notes make it clear that he had *O. hortense* mixed with his plant, and had failed to detect the admixture.

O. ligulatum C. M., from an original specimen sent me by Dr. Brotherus, is absolutely identical with Venturi's specimen *leg.* W. Bell.[*]

O. cyathiforme is probably frequent throughout New Zealand. It grows principally on trees, but occasionally on rocks.

11. **Orthotrichum pulvinatum** R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 426 (1894).

Syn. *O. calcareum* R. Br. ter., *op. cit.*, p. 427. *O. fimbriatum* R. Br. ter., *op. cit.*, p. 430. *O. reflexum* R. Br. ter., *op. cit.*, p. 431. *O. oamaruense* R. Br. ter., *op. cit.*, vol. 35, p. 332. *O. oamaranum* R. Br. ter., *op. et loc. cit.* *O. rupestriforme* Vent. in Rev. bryol., 1896, p. 67. *O. rupestre* N.Z. auctt., *nec*, Schleich.

This and the following species belong to the group of which *O. rupestre* Schleich is the type. They are mostly rupestral, but are occasionally found on trees. The tufts are generally dense and robust, often tall, usually dark brown; the calyptra is large, brown, densely pilose, the capsule emergent only or quite immersed, large, barrel-shaped, but when dry and empty somewhat contracted below the mouth so as to become urceolate. It is usually deeply ribbed, but may be only faintly so, or even quite smooth. The lid has a deep red border; the peristome is marked in having the outer teeth erect, not reflexed when dry. I have seen no mention of the processes in the present species, and in well-developed specimens I have failed to find them; it is probable that they are quite wanting, or that as in the case of the European *O. rupestre* they may be at times more or less developed, but fugacious, and at other times not present. The exothecium cells are elongate, rectangular, with the longitudinal walls strongly incrassate. Stomata in the lower, middle, or upper part of the capsule, apparently indiscriminately.

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[*] In the article referred to, in Rev. bryol., 1896, "Notice sur quelques espèces d'Orthotrichum de l'Australie," Venturi writes that the specimens sent to him by Dr. Brotherus came from Tasmania, gathered by Dr. Weymouth. I suspect some confusion here. The specimens of the three new species described in the article, sent to me by Dr. Brotherus as representing Venturi's species, were all collected in New Zealand by W. Bell. It would, of course, be possible—though unlikely—that all three were originally collected in Tasmania by Weymouth, and were also found by Venturi among Bell's New Zealand plants; but this remote possibility is, I think, quite disposed of by the fact that none of the species are included by Rodway in the "Tasmanian Bryophyta—Mosses" published in 1914. This work is based very largely on Weymouth's collections, and his Orthotricha were especially mentioned as having been submitted to Venturi, but the only species included in the work are *O. tasmanicum* H. f. & W., *O. laticiliatum* Vent., and *O. Lawrencii* Mitt. There is every reason to believe, therefore, that the three new species described by Venturi were actually based on Bell's New Zealand plants, and that the specimens sent me by Dr. Brotherus represent the type gatherings.

Both this and the following species are based by Venturi on the peristome characters alone, but there is a character common to both by which they differ very markedly in the leaves from *O. rupestre*. The leaves are broad, rigid (the cells being strongly incrassate), erect or erecto-patent and strict when dry, as in the European plant; but, unlike that, they are often, especially the apical ones, highly erose-papillose, so as to be irregularly denticulate near the apex, which is acutely pointed and sometimes subhyaline; other leaves, especially the lower ones, being simply acute, more or less highly papillose, and entire.

The peristome character by which this species is separated by Venturi from its European ally consists in the fact that the teeth are densely papillose, instead of being, as in that, smooth, or only very faintly papillose. They may be pale or dark brown. The presence of the preperistome, with the smoothness of the dorsal surface of the teeth, separates the following species from this.

I have a plant, however, collected by Mr. D. Petrie (Swan's Flat, Tuapeka County), which is very perplexing. It is one tuft out of three, two of which have the normal peristome of *O. rupestriforme*, while the third, in other respects similar, shows the outer teeth semi-translucent, covered with sparse, low, rather large papillae, instead of the dense, opaque covering of minute papillae of *O. rupestriforme*; they show no trace of preperistome. I can only suppose that it is an abnormal form of this species; but the very marked departure from the type in the peristome, taken in conjunction with the somewhat variable teeth (as to form and development) in the species, and a certain degree of variability in the same respects in *O. praeperistomatum*, lend themselves to a certain suspicion as to the constancy of the characters by which the two species are separated.

O. rupestriforme appears to be widely spread and probably frequent in the South Island, but I have not seen it from the North Island. Several of R. Brown's gatherings specify the substratum to be calcareous, and it is probable that this is the normal habitat.

12. **Orthotrichum praeperistomatum** Vent. in Rev. bryol., 1896, p. 67.

This species differs from the last, so far as I have studied it, in only one respect, but that a very marked one: having the peristome-teeth not densely papillose, but smooth or nearly so, yellow and pellucid, and having thickenings on their dorsal surface consisting of scattered nodules of a deeper orange, forming a very irregular but quite marked preperistome.

Venturi, it is true, gives as an additional character the capsule smooth, without any trace of ribs: and this is markedly the case with Bell's specimen from Mount Alfred, which I take to be the original gathering. But in Mr. Petrie's specimen from Vincent County, while the peristome is distinctly that of *O. praeperistomatum*, the capsules are markedly ribbed, and both of the species of this group must be considered to share the variableness in ribbing which is a noteworthy feature in the European *O. rupestre*.

I have only seen this species from three localities, all in the South Island: one from Mount Alfred, on rocks with *Andreaea*, *leg.* W. Bell, sent me by Dr. Brotherus: another from "dry rocks, Roxburgh, Otago," also collected by Bell; and the third collected by Mr. Petrie on "Speargrass Hill, Vincent County, Otago." Further study in the field may decide whether, as is certainly suggested by the first habitat (with *Andreaea*), this species may be a native of siliceous, non-calcareous rocks, as contrasted with *O. rupestriforme*, which is frequently at least a calcareous species.

EXCLUDED SPECIES.

These will all be found under the synonymy of *Ulota lutea*.

ULOTA Mohr, MS., Brid.

A genus very close to *Orthotrichum*, but usually of a different habit, having the leaves very crisped when dry, the capsule fully exserted on a long seta, the calyptra usually very hairy, and the stomata confined to the region of the base of the capsule. The leaves have a more distinctly widened base, and the areolation is somewhat distinct.

Ulota lutea Mitt. in Journ. Linn. Soc., Bot., iv, 77 (1859).

> Syn. *Orthotrichum luteum* H. f., Handb. N.Z. Fl., p. 433. *O. gracillimum* R. Br. ter. in Trans. N.Z. Inst., vol. 27, p. 427 (1894). *O. flexifolium* R. Br. ter., *op. cit.*, p. 428. *O. tortulosum* R. Br. ter., *op. cit.*, p. 432. *O. parvulum* R. Br. ter., *op. cit.*, p. 439. *O. erectum* R. Br. ter., *op. cit.*, p. 441. *O. otiraënse* R. Br. ter., *op. cit.*, vol. 35, p. 333 (1902).

U. lutea is easily known from the various species of *Orthotrichum* by the yellowish tufts with leaves strongly curled when dry, the densely hairy calyptra, and the longly exserted, narrow, ribbed capsules. The only species that it is at all likely may be confused with it is *O. tasmanicum*, which may in some of its forms be quite difficult to separate: the leaves in the *Ulota* are narrower and more crisped when dry, the calyptra somewhat more hairy. But the most crucial test is the position of the stomata—in the *Ulota* confined to the neck of the capsule, in *O. tasmanicum* scattered about the capsule-wall.

I have examined all Brown's species of *Orthotrichum* in the above synonymy except *O. erectum* and *O. otiraënse*; the latter certainly, and the former in all probability, from the descriptions and figures, belong here (though *O. erectum* might possibly belong to *O. tasmanicum*).

U. lutea is widely distributed throughout the Islands, both North and South, and extends to Tasmania.

MACROMITRIUM Brid., Mant. M., p. 132 (1819).

A large genus of mosses, including more than four hundred species, widely distributed in the warmer regions of the world, and like all such genera, presenting a good deal of plasticity in the species, and thereby much difficulty in the taxonomy. This difficulty has led to a complication in connection with the New Zealand species, from the inclusion in its list of several of the earlier-described species since resolved into segregates, as well as one or two clearly erroneous records. The list here given therefore differs very materially, both by omission and addition, from that given in the Handbook of the New Zealand Flora.

Fruit is needed in good condition to determine most of the species with any degree of accuracy—the calyptra (hairy or naked), the peristome (present or absent), and the form and surface of the capsule, and length of seta, affording test characters. Most of the New Zealand species belong to the section Goniostoma of the subgenus *Eu-macromitrium*, in which the capsule, while smooth below, is finely plicate and plaited just at and below the orifice (old capsules are often plaited throughout).

The arrangement and direction of the leaves when dry is a character of great importance though (as I have pointed out in an article in Bull. Torr. Bot. Club, 42, pp. 97-98) it may be modified in some species according to the conditions under which the plant has grown.

The key will, I think, be found helpful, but too much reliance must not be placed on it.

KEY TO THE NEW ZEALAND SPECIES.

1.	Leaves ending in a long piliferous arista, lost in all but the younger ones	2
	Leaves not piliferous	3
2.	Leaves spirally enrolled round the stem when dry	*caducipilum.*
	Leaves spirally twisted on their own axis when dry	*retusum.*
3.	Leaves straight and more or less erect when dry, not twisted ..	4
	Leaves more or less twisted when dry	6
4.	Robust plants with large leaves ; calyptra naked	*orthophyllum.*
	Plant very slender ; leaves about 1 mm. long ; calyptra hairy ..	5
5.	Leaves erecto-patent when moist	*eucalyptorum.*
	Leaves subsquarrose when moist	*recurvulum.*
6.	Robust plants ; capsule more or less fusiform, plicate throughout ; calyptra glabrous	7
	Capsule from subcylindric to ovate, smooth (until old), plicate at mouth only	8
7.	Seta short, stout ; leaves narrowly acuminate	*longirostre.*
	Seta about 1 cm., thin ; leaves more or less undulate	*Hectori.*
8.	Leaves ligulate or subulate from a wider base ; branches elongate (1–2 cm.), straight ; leaves when dry somewhat regularly spirally arranged and with strongly enrolled apex	*gracile.*
	Leaves wider, acute or obtuse	9
9.	Leaves acute ; calyptra naked	10
	Leaves obtuse or very shortly acute	11
10.	Robust ; orange-brown ; branches long, 1–2 cm. ; leaves closely spirally enrolled when dry ; seta elongate (to 2·5 cm.) ..	*longipes.*
	Slender, usually olive green ; branches about 1 cm. ; leaves very regularly spirally arranged when dry, with enrolled apex, lingulate-lanceolate, acute ; seta 1–1·5 cm.	*Weymouthii*
11.	Cells 7–11μ, usually obscure with numerous low papillae ..	12
	Cells large, 9–14μ, usually distinct, with a high central mamilla or papilla	13
12.	Calyptra naked	*ligulare.*
	Calyptra sparsely hairy	*prorepens.*
13.	Calyptra hairy	14
	Calyptra naked	*pusillum.*
14.	Peristome O	15
	Peristome present	16
15.	Branches very short, rarely 1 cm. ; leaves crisped when dry ..	*grossirete.*
	Branches elongate ; leaves closely spirally twisted when dry ..	*rigescens.*
16.	Branches short ; leaves crisped when dry	*erosulum.*
	Branches elongate ; leaves appressed, only slightly twisted when dry	*Petriei.*

Subgen. I. MACROCOMA Hornsch.

1. **Macromitrium eucalyptorum** Hampe & C. M. in Linn., xxvi (1853), p. 500.

Syn. *M. microphyllum* H. F. & W., Fl. N.Z., ii, 80; Handb. N.Z. Fl., p. 431 (nec *M. microphyllum* Hook. & Grev.) *fide* Brotherus.

Quite distinct from all the species except the succeeding in the slender stems and rigid habit, with straight branches, minute leaves, straight, erect, and rigidly appressed when dry, the small elliptic capsule and hairy calyptra.

Widely distributed over the North and South Islands, Tasmania, and Australia. I follow Brotherus in keeping the Australasian plant separate from the original *M. microphyllum* of South Africa, but I have not compared them critically, and do not know on what he bases the distinction.

2. **Macromitrium recurvulum** C. M. in Hedwig, vol. 37, p. 143 (1898) (nec *M. recurvulum* Card. in Rev. Bryol., 28, p. 113 (1901)).

A very pretty little plant, of which I have a small specimen sent me, mixed with *M. eucalyptorum*, from Kopuaranga, Wairarapa, North Island, by Mr. W. Gray. The leaves are markedly squarrose when moist and quite distinctly recurved at the apex when dry; the seta is shorter and the capsule smaller; otherwise it does not appear to differ from *M. eucalyptorum*. It has, I believe, not been recorded elsewhere since the original gathering by Beckett in the Waimakariri Gorge, South Island.

Subgen. II. EU-MACROMITRIUM C. M.

Sec. *Goniostoma* Mitt.

3. **Macromitrium orthophyllum** Mitt. in Journ. Linn. Soc., Bot., vol. 4, p. 79 (1859); Handb. N.Z. Fl., p. 430.

A very distinct species, robust, and known at once by the large leaves scarcely altered when dry, erect and appressed, or sometimes slightly twisted in a spiral. The seta is stout, about 1 cm. long; the capsule rather large, about 2 mm. long,* elliptic, becoming plicate after maturity. Calyptra naked, ofter split more highly on one side.

Only North Island localities are given in the Handbook, but I have it from several stations in the South Island.

4. **Macromitrium longipes** (Hook.) Schwaegr., Suppl., ii, p. 147, t. 139 (1824); Fl. N.Z., ii, 78; Handbook N.Z. Fl., p. 429.

Syn. *Orthotrichum longipes* Hook., Musc. Exot., t. 24 (1818).
Macromitrium lonchomitrium C. M. in Hedwig., vol. 37, p. 148.

In its ordinary forms a very distinct species, with long robust branches, having the leaves somewhat spirally enrolled both on the stem and on their own axes, and incurved at the points, when dry; the seta very long and flexuous. Unfortunately these characters, expecially the length of the seta, are not always marked, and the species may not be easy to recognize from them; but the generally rather tapering leaves, strongly recurved margins, minute, incrassate, opaque, almost smooth cells, rather large elliptic capsule, and large naked calyptra will generally aid in determining it.

A widely distributed plant in New Zealand.

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* The measurements of the capsule are given without including the lid.

C. Mueller gives no characters in his description of *M. lonchomitrium* to separate it from *M. longipes*. He states that it is "*M. longipedi* simillimum," but adds that that species has the seta "arcuato-flexuoso." This, however, is not the case; the seta may be flexuose, but is certainly not arcuate, and is frequently quite straight, and varies in stoutness considerably. Original specimens, *leg.* R. Helms, Greymouth, N.Z., ex. herb. C. Mueller, *comm.* New York Bot. Garden, agree exactly with *M. longipes*. There is no difference in the seta.

The basal areolation, it may be added, in *M. longipes* is rather remarkable: the cells are rather widely elongate-rectangular, in regular rows, but the walls are very incrassate, and the cell-lumen is extremely narrow, almost filiform, and instead of being straight and parallel with the longitudinal walls it is vermicular, S-shaped, or semilunar, giving a very curious aspect to the areolation.

5. **Macromitrium Weymouthii** Broth. in Oefv. af Finska Vet.-Soc. Foerh., 37, p. 59 (1895).

Syn. ? *M. flaccidisetum* C. M. in Hedwig., vol. 37, p. 147. *M. pseudo-hemitrichodes* C. M., *op. cit.*, p. 150. *M. recurvifolium* H. f. & Wils. (*non* Brid.), Fl. N.Z., ii. 78; Handb. N.Z. Fl., p. 430.

This species may be described as in many respects a small edition of the preceding, with which it has many points in common. It is, however, much smaller, of a usually dull olive-green or brown colour, while *M. longipes* is, as a rule—at least, after drying—of a bright-reddish brown. The leaves, as in that, are marked by a wide deep furrow on one side of the nerve only. The basal areolation differs: the lumen, while being narrow, is not so markedly so, and is nearly or quite straight.

It is a frequent species, and in the Handbook it is probably not overlooked, but appears under a different name—viz., *M. recurvifolium* Brid.—a Javan species which has broader, shorter leaves, more obtuse, closely spirally arranged when dry, with the points not enrolled as here.

From the descriptions of *M. flaccidisetum* and *M. pseudo-hemitrichodes* C. M. I have no doubt whatever that they belong here.

6. **Macromitrium longirostre** (Hook.) Schwaegr., Suppl., ii, p. 38, t. 112 (1823).

Syn. *Orthotrichum longirostre* Hook., Musc. Exot., t. 25 (1818). *Macromitrium pertorquescens* C. M. in Hedwig., vol. 37, p. 148 (1898).

One of the most distinct of the New Zealand species, from the robust, rigid habit, the very acute leaves somewhat spirally twisted, loosely and very rigidly, with the points sticking out and bristling, when dry; the very short, stout seta, and elongate, fusiform capsule, plicate throughout its length.

It is a plant of subantarctic distribution (Chile; Auckland, Chatham, and Campbell Islands; Stewart and Southern Islands; and Tasmania); it has not, I believe, been recorded from the North Island.

I have examined the type specimen of var. *acutifolium* H. f. & W. in Hooker's Herbarium. It cannot, I think, be allowed varietal rank; in fact, the specimen scarcely seems to bear out the characters attributed to the variety—the leaves do not seem to be any more acute than in the type.

7. **Macromitrium retusum** H. f. & W., Fl. N.Z., ii, 79; Handb. N.Z. Fl., p. 432 (1855).

This and the following plant are distinct from all the other species, and are remarkable for the nerve excurrent in a very long, piliform, green arista, often equal in length to the rest of the leaf. These are very fragile, and nearly always broken off in the older leaves, but the younger leaves usually show them at the stem-apex, where they appear as a penicillate tuft. The fruit of neither species has been found. I have compared the two species and pointed out their distinguishing characters at some length in a former paper (Journ. Linn. Soc., Bot., xl, 447). I will recall here the most distinct feature, derived from the position of the leaves when dry. In the next species the leaves are fairly regularly spirally twisted round the stem, but otherwise not much contorted or changed; here they are not twisted round the stem, but are spirally twisted on their own axis, and have their apex strongly enrolled or hooked; they take, in fact, much the position of the leaves in *M. gracile*. They are usually very regularly and uniformly twisted, and exhibit a very pretty arrangement, often of a spiral tendency; but this is owing to the spiral *position* of the leaves on the stem, not to a spiral *twisting* round it.

I have *M. retusum* from several localities in the North Island where it was first recorded; I have seen it from only one locality in the South Island—viz., Pine Hill, Dunedin—whence Mr. Petrie sent it to me.

8. **Macromitrium caducipilum** Lindb. in Oefv. af Finsk. Vet.-Akad. Foerh., p. 605 (1864).

Syn. *M. aristatum* Mitt. ex Hook. f. in Handb. N.Z. Fl., p. 432 (1867).

In addition to the character mentioned above, this species differs from *M. retusum* in the leaves nearly erect when moist—there widely spreading—and in the cells much more distinctly defined.

No specimen of *M. aristatum* Mitt. exists at Kew, but Mrs. Britton has kindly allowed me to see part of the original gathering (Auckland, ex herb. Buchanan), and I have been able to compare this with Lindberg's species, and find the two to be absolutely identical.

Mr. James Murray collected it in 1907, also in the vicinity of Auckland. I know of no other recent records: Lindberg's original plant is only recorded as "e Nova Zelandia (Coll. Ralfs[*]) inter *Leptostomum macrocarpum*."

9. **Macromitrium gracile** (Hook.) Schwaegr., Suppl., ii, p. 39, t. 112 (1823); Fl. N.Z., ii, 78; Handb. N.Z. Fl., p. 429.

Syn. *M. Mossmannianum* C. M. in Bot. Zeit., 1851, p. 561 (*fide* Mitt.). *M. appendiculatum* C. M. in Hedwig., vol. 37, p. 156 (1898) (*fide* Brotherus). *M. Helmsii* Par. Ind., Suppl., p. 238 (1900).

In its usual forms a very pretty species: the long, straight branches passing from yellow-green above to bright orange-brown below. The leaves are very equal all along the branches, which are therefore very uniform throughout, and in the dry state very prettily foliate, each leaf being strongly circinnately enrolled at the tip, so that the points are quite hidden and the stems terete, while at the same time the enrolling is so regular and uniform that the spiral arrangement on the branch is generally brought out rather clearly. The seta is short, the capsule more strongly plicate than in most of the species.

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[*] Probably Thomas Shearman Ralph, who collected in New Zealand about 1850–60.

M. gracile appears to be a common species.

10. Macromitrium Hectori Mitt. ex Hook. f., Handb. N.Z. Fl., p. 430 (1867).

A little-known species gathered, so far as I know, only in the original station, Otago, by Hector and Buchanan. (A specimen so named, and distributed by Beckett, coll. T. G. Wright, from Canterbury, is only *M. prorepens*.) It is rather robust, and is perhaps allied to *M. longirostre*, of which it has the plicate capsule; golden brown, somewhat glossy, the leaves somewhat undulate when moist, very densely set, closely incurved and twisted when dry, but not crisped or spirally contorted. The cells are minute, very distinct and incrassate, oval and slightly oblique, the basal strongly incrassate and with a rather curious and complicated thickening at the upper and lower ends. The leaf-apex is peculiar among the New Zealand species, and at once separates the plant from *M. longirostre*, being broad and obtuse, abruptly ending in a rather long acute cuspidate point, not, however, formed by the nerve, which, usually at least, ceases at some distance below. The seta is 1 cm. long or rather less, not at all stout—on the contrary, rather slender and flexuose.

The remaining seven species form a group of closely allied plants, scarcely differing from one another except in calyptra (naked or hairy), peristome (absent or slightly developed), and two forms of cell-structure. The permutations of these three pairs of characters for the most part constitute the specific differences. The plants are mostly slender, with short branches, small oval capsules, and small leaves, which scarcely vary in form throughout the group, being oblong-lingulate, subobtuse, and generally shortly mucronate, the upper cells being sharply differentiated from the lower, which occupy a large proportion of the leaf, and are pellucid, usually yellowish, elongate, linear, and incrassate. The upper cells are of two characters, which I have described in some detail in a previous paper (Bull. Torr. Bot. Club, 42, 97, sqq.). *M. prorepens* and *M. lingulare* have them moderately large (7-11μ), obscure by reason of two or three distinct but not high papillae on each. In the other species the cells are distinctly larger (9–14μ), each cell crowned by a high, often conspicuously spiculose papilla, which does not render them obscure, but, on the contrary, they are very clear and distinct.

11. Macromitrium prorepens (Hook.) Schwaegr., Suppl., ii, p. 62, t. 171 (1826); Fl. N.Z., ii, 79; Handb. N.Z. Fl., p. 431.

Syn. *Orthotrichum prorepens* Hook., Musc. Exot., t. 120 (1818–20). *Macromitrium submucronifolium* Hpe. & C. M. in Linn., xxvi (1853), p. 499. *? M. coarctatulum* C. M. in Hedwig., vol. 37, p. 153. *? M. oocarpum* C. M., *op. cit.*, p. 157.

Distinguished from *M. lingulare* by the sparsely hairy calyptra; from all the subsequent species by the smaller, obscure upper areolation.

From the descriptions I think there can be no doubt of the identity with *M. prorepens* of C. Mueller's two species placed in the synonymy.

It is common throughout New Zealand.

12. **Macromitrium ligulare**[*] Mitt. in Journ. Linn. Soc., Bot., iv, 78 (1859).

Syn. *M. asperulum* Mitt. in Fl. Tasm., ii, 376 (1860); Handb. N.Z. Fl., p. 429. *M. fimbriatum* H. f. & W., Fl. N.Z., ii, 77 (nec *M. fimbriatum* Schwaegr.).

Very closely resembling *M. prorepens*, but differing in the naked calyptra and practically entire absence of peristome.

I have carefully examined Mitten's *M. asperulum* at Kew, and am confident that it cannot be separated from *M. ligulare*.

I have it from both North and South Islands.

13. **Macromitrium pusillum** Mitt. in Journ. Linn. Soc., Bot., iv, 78 (1859).

This species, which has been omitted by error from Brotherus, "Musci," was described from Tasmanian specimens, but I have it from several New Zealand localities. It has the larger, distinct cells of the following plants, but is distinct from them in having the calyptra naked.

14. **Macromitrium erosulum** Mitt. in Journ. Linn. Soc., Bot., iv, 78 (1859); Handb. N.Z. Fl., p. 431.

Differs from *M. grossirete* and *M. rigescens* in the presence of a peristome; from *M. Petriei* in the short branches with leaves crisped when dry. Probably one of the commonest species.

15. **Macromitrium Petriei** Dixon in Bull. Torr. Bot. Club, 42, 101 (1915).

Very close to *M. erosulum* in all structural characters, but taller, more robust, with elongate branches and leaves somewhat rigidly appressed and spirally twisted when dry, less crisped; colour reddish-brown.

I have only seen it from the original locality, Clinton Valley, Lake Te Anau; coll. D. Petrie.

16. **Macromitrium grossirete** C. M. in Hedwig., vol. 37, p. 153 (1898).

Syn. *M. papillifolium* C. M., *op. cit.*, p. 154.

Generally more robust than *M. erosulum*, with short, very turgid branches and strongly crisped leaves; the calyptra more densely hairy.

M. papillifolium differs in the remarkably high papillae of the leaf-cells; but this character does not appear to be correlated with any others, and it is too ill-defined to form the basis of a variety.

I have this species from several localities in the South Island, but it is perhaps not one of the more common species.

17. **Macromitrium rigescens** Broth. & Dixon in Journ. Linn. Soc., Bot., xl, 446 (1912).

Near *M. erosulum* and *M. grossirete*, but with elongate branches and rigidly appressed leaves when dry. It bears, in fact, to *M. grossirete* the same relationship as *M. Petriei* to *M. erosulum*, and is scarcely distinguishable from *M. Petriei* except by the absence of peristome.

I have found several specimens referable to this species in the herbarium of R. Brown from the South Island, but without further locality.

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[*] *M. lingulare*, Par. Ind., *false*.

EXCLUDED SPECIES.

M. sulcatum Brid.—Recorded with doubt in the Handbook ("var. β, leaves less acuminate, scarcely undulate, probably a different species; Northern I., Colenso. A doubtful determination.") The only specimen in Hooker's herbarium at Kew is labelled "*M. sulcatum.* N. Zld. Sinclair," in Mitten's hand. This is certainly *M. sulcatum*, but the specimen is undoubtedly wrongly labelled. The *Macromitrium* is closely interwoven with two other plants, a *Campylopus* and a species of *Diaphanodon*, the latter a frequent genus in south India (the home of *M. sulcatum*), but unknown in New Zealand.

M. recurvifolium (Hook. & Grev.) Brid., Fl. N.Z., ii, 78; Handb. N.Z. Fl., p. 430.—The specimens in Hooker's herbarium (coll. Hooker and Logan) are *M. Weymouthii* Broth. Colenso's and Kerr's are not represented, but no doubt belonged to the same plant. *M. recurvifolium* is a Javan species.

M. mauritianum? Schwaegr., Suppl., t. 189; Fl. N.Z., ii, 79; Handb. N.Z. Fl., p. 430.—"Bay of Islands. Logan. A doubtful plant." No New Zealand specimens occur at Kew. It must certainly be dropped from the New Zealand flora.

M. incurvifolium Schwaegr., Suppl.; Fl. N.Z., ii, 79; Handb. N.Z. Fl., p. 431.—"Dusky Bay. Menzies." No doubt, as suggested in the Handbook, an error in recording the locality.

M. hemitrichodes Schwaegr., Suppl., t. 193; Fl. N.Z. ii, 79; Handb. N.Z. Fl., p. 431.—"Northern I., Logan." The specimen in herb. Hook. is marked "H. 595. ? *M. hemitrichodes* var." It has a naked, not hairy calyptra. It is certainly *M. Weymouthii* Broth. The Australasian *M. hemitrichodes* is very closely allied to some of the New Zealand species, but I have seen no specimens that seem referable to it.

M. microstomum Schwaegr., Handb. N.Z. Fl., p. 431.—All the so-named specimens at Kew belong to *M. Weymouthii* Broth.

M. *piliferum* Schwaegr., Handb. N.Z. Fl., p. 432.—A Pacific species, certainly to be excluded.

M. abbreviatum Mitt., MS. in herb.—I have received authentic specimens of this from the New York Bot. Garden, and have also examined Mitten's specimens at Kew. Some of these belong to *M. erosulum* Mitt. and some to *M. prorepens* Schwaegr.

M. barbatum Mitt., MS. in Herb. Kew., is *M. eucalyptorum.*

M. Knightii Schimp, MS. in herb., and *M. clavatum* Schimp., MS. in herb., are *M. longipes.*

M. rigidum Schimp., MS. in herb., is *M. orthophyllum.*

M. laevigatum Schimp., MS. in herb., is *Schlotheimia Brownii* Brid.

M. perpapillosum Broth., MS. in sched., herb. Beckett, is *M. erosulum.*

M. scabrum Broth., MS. in sched., herb. Beckett, is a strongly papillose form of *M. grossirete.*

M. tasmanicum Broth., in sched., "*forma*, N.Z., Rev. Colenso, 4096, det. Brotherus," agrees with the spiral-leaved forms of *M. Weymouthii* exactly, except that the single calyptra is sparsely hairy. It is best, I think, left doubtful.

M. involutifolium (Hook. & Grev.) Schwaegr., is given by Brotherus ("Musci," p. 488) as from Australia and New Zealand; but Dr. Brotherus informs me that he has seen no New Zealand specimens. The New Zealand record has probably crept in by error.

M. spirale Hampe, MS., *e* Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 63 (*nomen solum*), is *M. Weymouthii*.

M. submicrophyllum Hampe, M.S. in herb., is *M. eucalyptorum*.

SCHLOTHEIMIA Brid., Mant. Musc., p. 114 (1849).

This well-defined genus, of somewhat large dimensions in the southern tropical and temperate zone, is only represented in New Zealand by two species, one of them being only found in and endemic to Campbell Island.

It resembles *Macromitrium* in general habit, generally forming close compact tufts or mats, brownish when old, with the leaves closely spirally twisted when dry, more or less lingulate or oblong-lingulate, generally rugulose above; it differs markedly from *Macromitrium* in the calyptra, which is smooth, neither plicate nor hairy, though usually scabrous or hispid at the apex.

1. **Schlotheimia Brownii** Brid., Bryol. univ., i, 799 (1826); Schwaeg., Suppl., ii, t. 167 (1826); Fl. N.Z., ii, 77; Handb. N.Z. Fl., p. 427.

Syn. *S. Baileyi* Broth. in Oefv. af Finska Vet.-Soc. Foerh., vol. 33, p. 198 (1890). *S. Knightii* C. M. in Hedwig. vol. 37, p. 142 (1898).

A frequent species in New Zealand and Australia. Watts and Whitelegge (Cens. Musc. Australens., ii, 107, in Proc. Linn. Soc. N.S.W. for 1905) say, under *S. Brownii*, "Broth. Bryales gives N.Z. only, and in a letter he says, I have not seen *S. Brownii* from Australia, and doubt if it is to be found there. Probably all the Australian records should be changed to *S. Baileyi*." A remarkable statement, since the type of *S. Brownii* was collected at Port Jackson in Australia by Brown (and is cited by Watts and Whitelegge)!

On the other hand, C. Mueller separates his New Zealand *S. Knightii* n. sp. from *S. Brownii*, giving it a description which would certainly cover all the New Zealand plants attributed hitherto to *S. Brownii* a species which is therefore apparently to be allowed no resting-place anywhere, either in Australia or in New Zealand. I doubt if Bridel's species is to be got rid of so easily.

Brotherus founds his *S. Baileyi* on a Queensland plant, *leg.* Bailey. This I have not seen; but Watts and Whitelegge describe it as plentiful in New South Wales, and I have a specimen det. Brotherus (Watts N.S.W. Mosses, 1273). This appears to me quite identical with *S. Brownii*. Brotherus (*loc. cit.*) distinguishes it thus: "Colore laete viridi, foliis vix rugulosis, bracteis perichaetii haud exsertis, seta brevi, gracili, theca brevi, sulcato, et calyptra haud scabra facile dignoscitur." Watts's 1273 shows no difference in the colour of the tufts from many specimens of *S. Brownii* I have seen. As to the other characters enumerated, C. M., Syn., i, 755, describes *S. Brownii* as having "folia alis *parum* rugulosis . . . Perichaetia conformia . . . theca sicca plicata . . . calyptra . . . vix scabra" (thus agreeing with Brotherus' description of *S. Baileyi*).

The only separating character remaining is that C. Mueller describes the seta as long, and Brotherus that of *S. Baileyi* as short. The measurement given, however (4 mm.), is no shorter than frequently occurs in New

Zealand specimens of *S. Brownii*, where it (as well as the length of the capsule) is eminently variable, and sometimes does not exceed 3 mm.

I conclude, therefore, that Brotherus must have misunderstood *S. Brownii* Brid., and that *S. Baileyi* must be dropped.

To turn to *S. Knightii* C. M.: This is based on a New Zealand specimen of Knight's, from Hampe's herbarium, originally labelled *S. Brownii*. Good and abundant specimens of this occur in Hampe's herbarium, but they exhibit no differences from the Australian *S. Brownii*. Nor do the distinguishing characters as given by C. Mueller and as understood by Hampe agree with one another. Hampe's MS. description of *S. Knightii* is "differt a *S. Brownii* Schw.—Statura robustiore, foliis longioribus, oblongo-lingulatis, erecto-patulis nervo evanido cal. glabra, basi fimbriata." But, except for the comparison in size (which is of no account), since the plant varies considerably in the dimensions of all its parts with no correlated structural characters), all these characters apply perfectly to *S. Brownii*.

C. Mueller bases his conception of the species quite otherwise: "*S. Brownii* foliis longius acutis mucronatis e cellulis multo minoribus jam differt." The actual specimens, however, show no difference whatever from the ordinary Australian and New Zealand forms in these characters; the cells in *S. Knightii* are no larger at all.

He adds that *S. Baileyi* Broth. equally differs "prima fronte" in the leaves "acute longius mucronatis," the leaves of *S. Knightii* being described as "breviter acuminatis." Now, Brotherus describes the leaves of *S. Baileyi* as "obtusa, breviter apiculata," so that C. Mueller's distinction is not only non-existent but self-contradictory. He is in fact describing simply the more robust forms of *S. Brownii*, and the other characters given are purely imaginary. In fact, as to general leaf-outline, nerve and cell structure, the whole range of plants is, considering the variability in dimensions and habit, singularly uniform. The nerve ceases constantly just below the apex, but the form of the apiculus and some obscurity of the areolation often give the false appearance that the apiculus is due to the excurrence of the nerve, and this is incorrectly figured by Schwaegrichen, t. 167, fig. 5.

S. Brownii grows on trees and rocks, and is probably well distributed.

2. **Schlotheimia Campbelliana** C. M., Syn., i, 753 (1851); Handb. N.Z. Fl., p. 427.

> Syn. *S. quadrifida* H. f. & W., Fl. Antarct., i, 126 (1844) (nec *S. quadrifida* Brid., Mant. Musc., p. 114 (1819)).

This species, confined to Campbell Island, is at once distinguished from *S. Brownii* by the nerve excurrent in a rather long, slender, cuspidate point, and by the stouter seta.

SPLACHNACEAE.

TAYLORIA Hook in Journ. Sci. & Arts, No. 3, p. 144 (1816), emend. Mitt. in Journ. Linn. Soc. Bot., iii, Suppl., p. 57 (1859).

This genus has been widened to include as subgenera several groups which have by one author or another been treated as separate genera, including *Eremodon* Brid., under which the three New Zealand species are found.

KEY TO THE SPECIES.

1.	Leaves sharply toothed above	1. *calophylla.*
	Leaves entire, or slightly and obtusely toothed	2
2.	Leaves very wide; cells in divergent rows; nerve not reaching apex	2. *purpurascens.*
	Leaves narrower; cells not in divergent rows; nerve excurrent in upper leaves	3. *octoblepharis.*

1. **Tayloria calophylla** (C. M.) Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 65.

Syn. *Dissodon calophyllus* C. M. in Bot. Zeit., vol. 9, p. 546 (1851). *Eremodon robustus* H. f. & W., Fl. N.Z., ii, 93; Handb. N.Z. Fl., p. 452.

The most robust species, especially in the fruit, and distinguished at once by the sharply toothed leaves with vanishing nerve; the erect clavate capsule with minute conical lid recalls that of *Brachymenium* and *Leptostomum.*

It has been found, I believe, only in the North Island and in Tasmania.

2. **Tayloria purpurascens** (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 502 (1903).

Syn. *Splachnum purpurascens* H. f. & W. in Lond. Journ. Bot., iii, 1844, p. 529. *Eremodon purpurascens* Hook. f., Handb. N.Z. Fl., p. 452 (1867). *Dissodon purpurens* C. M., Gen. Musc. Frond., p. 124 (*nomen*).

This and the following species are nearly allied, but they are not identical as suggested by Hooker in the Handbook. The leaves are very widely obovate-spathulate, whereas in *T. octoblepharis* they are rather narrowly obovate. A more distinct structural character is found in the areolation, the cells here being arranged in regular divergent rows, which is not the case in *T. octoblepharis.* Both species have the leaves at times distinctly denticulate.

So far as my specimens indicate, the present is a less variable species than the following. The seta is, I believe, pretty constantly longer, and sometimes reaches 3 cm.; but as in most of the Splachnaceae this character is a very inconstant one.

T. purpurascens is known from both the North and South Islands, and also from the Auckland and Campbell Groups.

Dissodon purpurens C. M. (type, in Berlin Museum) is quite inseparable from this species.

3. **Tayloria octoblepharis** (Hook.) Mitt. in Trans. & Proc. Roy. Soc. Victoria, 1882, p. 65.

Syn. *Splachnum octoblepharum* Hook., Musc. Exot., t. 167 (1820). *Eremodon octoblepharis* H. f. & W., Fl. N.Z., ii, 94 (1855); Handb. N.Z. Fl., p. 452. *Dissodon longicollis* C. M., Gen. Musc. Frond., p. 124 (*nomen*).

This is a highly variable plant, but the variation is, I believe, mostly concerned with the dimensions of the various parts, absolute and relative, and I scarcely think that good varietal characters can be defined. The variations affect both the vegetative and fruiting parts; the seta, for instance may be barely the length of the capsule (with apophysis), while on the other hand it may reach to 2 cm. The nerve is usually excurrent in the upper leaves in a long flexuose arista.

The species has a wide distribution in the Australasian region.

Dissodon longicollis C. M. (type, in Berlin Museum) is certainly to be referred here.

FUNARIACEAE.

GIGASPERMUM Lindb. in Oefv. af K. Vet.-Akad. Foerh., 1864, p. 599.
(For synonymy see the species).

Gigaspermum repens (Hook.) Lindb., *op. et loc. cit.* (1864).

Syn. *Anictangium repens* Hook., Musc. Exot., t. 106 (1820). *Hedwigia repens* H. f. & W., Fl. N.Z., ii, 92 (1855). *Leptangium repens* Mitt. in Journ. Linn. Soc., Bot., iv, 79, (1859); Handb. N.Z. Fl., p. 424. *Physcomitrium repens* C. M., Syn., ii, 544. *Gigaspermum tenellum* C. M., MS. in Herb. et Gen. Musc. Frond., p. 130.*

This rare and peculiar little moss has given taxonomists much trouble as the above synonymy shows. It has no doubt found its true place in the Funariaceae. This is confirmed in a rather interesting way by the discovery of the type of a new genus (*Chamaebryum* Thér. & Dixon) in South Africa, which links up the South African *Gigaspermum Breutelii* (C. M.) Par. with undoubted Funarioid genera. *G. repens* occurs in Australia and Tasmania. It was first found in the North Island of New Zealand by Colenso. I am aware of only two gatherings since then, one by R. Brown. Unfortunately the specimens do not indicate the locality, beyond that it was probably in the South Island, since Brown was in the habit of distinguishing all specimens gathered by him in the North Island by so designating them. A third gathering was from Stewart Island, by Kirk. By the kindness of the Berlin Museum I have been enabled to examine Kirk's plant, the original of *G. tenellum* in herb. C. Mueller. The leaves are all simply mucronate or shortly cuspidate, and it is, I think, without doubt only the sterile plant of *G. repens*, in which the leaves of the sterile branches are normally of this form. No fruit was found.

The habit of growth, the fruiting-shoots being produced from the upper side of a creeping, often underground, rhizomatous stem, is one of the characteristic features, but is usually masked by the crowded fruiting-stems, which thus appear caespitose. They are conspicuous by the numerous large, hyaline, scarious perichaetial bracts, giving the tufts a white colour; the widely urceolate, almost sessile capsule is hidden within these bracts; the spores are remarkably large, reaching 70μ. in diameter.

PHYSCOMITRIDIUM Roth, die Aussereuropäisch. Laubm., i, 250 (1911).

Syn. *Ephemerella (Physcomitridium)* C. M. in Hedwig., xli, 120 (1902).

Roth is in error in attributing (*loc. cit.*) the genus to C. Mueller. Mueller described the species as an *Ephemerella*. In the Gen. Musc. Frond. the species drops out—at least, it does not appear under *Physcomitridium* or *Ephemerella*. Under *Physcomitrium* § *Cryptopyxis*, C. Mueller (p. 112) writes, "Auch kenne ich eine australische Art von Melbourne: *P. Readeri* n. sp., deren Mundoeffnung gleichsam nur eine Perforation ist." It is possible that this is the present plant masquerading under a new name. The generic name *Physcomitridium* must be attributed to Roth. Brotherus (Musci, i, 513) writes that from the description he is inclined to refer it to *Physcomitrella.* It is certainly, I should say, nearest to that genus, but is, I think, best kept separate. Roth (*loc. cit.*) places it next to *Physcomitrella*, but expresses a doubt as to whether it should or should not be united with that, as owing to lack of material he has not been able to examine the stomata of *P. Readeri.*

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* The synonymy given in Paris, Ind., ed. ii, is incorrect in several respects.

I have been able to study the stomata from R. Brown's material. They are very numerous, as in *Physcomitrella*, but they differ markedly. In that genus the perforation is small and elliptic (*cf.* Limpr. Laubm. Deutschl., &c., i, 158, fig. 59), bearing a small proportion to the size of its cell; in the present plant it is an elongate slit, as in most of the Funariaceae. Moreover, in *Physcomitrella* as figured by Limpricht the stomata are on a level with the exothecium cells, while here, as in *Funaria hygrometrica*, they lie slightly below the surface and are partly covered by the ends of the surrounding cells. On the whole, therefore, I have thought it best to retain the genus *Physcomitridium.*

Physcomitridium Readeri (C. M.) Roth, *op. et loc. cit.* (1911).

Syn. *Ephemerella Readeri* C. M. in Hedwig., xli, 120 (1902).

R. Brown gathered a plant "Banks, R. Avon, Oct., 1905," which he named in herbarium *Phascum Chiltonii.* This I find to be exactly identical with *Physcomitridium Readeri* as described and figured by Roth.

It is a very interesting little plant, like a minute *Pottia*, with the capsule slightly exserted above the leaves; but it is cleistocarpous: the capsule has a distinctly differentiated conical apiculus, but it does not separate as a lid. The calyptra is small, not covering more than about $\frac{1}{4}$ of the capsule; is conical and mitriform, slightly split at the base; the spores are large, 30–37μ, finely and distinctly echinulate. The leaves are obovate-spathulate, rounded above and obtuse, obtusely serrate near apex, very laxly areolate, with a nerve ceasing above the middle. The seta (with vagina) about equals $1\frac{1}{2}$ or twice the length of the capsule.

PHYSCOMITRIUM Fuernr. in Flora, xiii, p. 11; Ergaenz, p. 9 (1829).

Of the four species included in the Handbook, two are now placed in *Funaria;* the species there described as *P. piriforme* is now distinguished as *P. conicum.*

KEY TO THE SPECIES.

Seta very short; capsule immersed; calyptra very small	1. *pusillum.*
Seta elongate, capsule much exserted; calyptra larger	2. *conicum.*

1. **Physcomitrium pusillum** H. f. & W., Fl. N.Z., ii, 92 (1855); Handb. N.Z. Fl., p. 451.

A very small Phascoid moss, with immersed subglobose capsule, the calyptra covering only the conical lid, the leaves spreading when moist, incurved over the capsule when dry, spathulate, acuminate, subentire, the nerve nearly reaching apex.

It appears to be a very rare species in New Zealand, if not overlooked. It is endemic, and I do not know of any record of it but that of Sinclair, in the North Island.

2. **Physcomitrium conicum** Mitt. in Journ. Linn. Soc., Bot., iv, 79 (1859).

Syn. *P. pyriforme* var. *β* Hook. f. & W., Fl. N.Z., ii, 92; Handb. N.Z. Fl., p. 451; nec *P. pyriforme* Bry. eur.; *P. subserratum* Hampe in Linn., xxx, 623 (1860).

A smaller plant than the European *P. pyriforme*, with usually shorter and wider capsule, much shorter seta, and less beaked lid: but the structural differences are very slight. It occurs in dense, richly fruiting tufts, and cannot easily be taken for any other species; the large cells and toothed leaves separate it from similar species of *Pottia*, the form of capsule from *Funaria*. The spores are large (30μ or more), and highly echinulate.

I have examined the type of *P. subserratum* Hpe. in Hampe's herbarium; it is certainly *P. conicum*. The name was published about a year later than *P. conicum* Mitt.

EXCLUDED SPECIES.

P. apophysatum Wils. = *Funaria apophysata*.

P. Perrottetii Mont.: The only evidence of this at Kew is a drawing labelled "*Physcomitrium Perrottetii* ? N.Z. Knight 69: specimens sent on former occasion." There are no specimens attached, and no note. There is certainly no sufficient evidence here to warrant the inclusion of the Indian species here.

Under *Physcomitrium pyriforme* at Kew there is a scrap labelled by Mitten "*Physc.* (*pyriforme β pumilum*), New Zealand, Mr. Knight." accompanied by careful drawings, noted "69B." This may or may not be the "69" cited above. It is only a small form of *P. conicum*.

FUNARIA Schreb. in Linn. Gen. Plant., ed. 8, ii, p. 760 (1791) emend. Lindb.

Lindberg enlarged *Funaria* to include *Entosthodon*, in which he is followed by Brotherus. There is certainly no clear line that can be drawn to separate the two.

KEY TO THE SPECIES.

1.	Seta usually shorter than combined capsule and collum, rarely slightly longer; capsule suberect, clavate, with tapering collum of equal length; peristome 0	1. *apophysata*.
	Seta longer, usually much longer, than capsule with collum ..	2
2.	Lid conical, apiculate or umbonate	2. *subattenuata*.
	Lid flat or convex	3
3.	Capsule striate	8. *hygrometrica*.
	Capsule smooth	4
4.	Capsule erect, symmetric, subclavate (with the subequal collum); seta 5–7 mm. only, not much longer than capsule	5
	Seta above 1 cm., capsule much shorter	6
5.	Spores papillose, peristome double	4. *subcuspidata*.
	Spores smooth, peristome single	3. *Helmsii*.
6.	Capsule very asymmetric, curved, so that the mouth when deoperculate is usually vertical; peristome large, persistent	7. *glabra*.
	Capsule erect, symmetric; peristome very fragile, small ..	7
7.	Nerve excurrent	6. *cuspidata*.
	Nerve ceasing below apex	5. *gracilis*.

The species of *Funaria* do not, as a rule, show much difference in their vegetative characters, and the specific differences are for the most part drawn from the peristome. Unfortunately, while of high taxonomic value, this is of slight practical help, as the presence or absence of an inner peristome often cannot be satisfactorily determined unless the fruit is quite mature and in good condition ; while in some species it is so fragile and easily lost that a proper determination is hardly possible when the fruit is a little past maturity. The form of the capsule is, however, often of great help, and most of the species can be determined by this alone ; and, as the plants are for the most part fertile, the difficulty is not greatly felt.

1. **Funaria apophysata** (Tayl.) Broth in Engl. & Prantl, Pflanzenfam., Musci, i, 523 (1903).

Syn. *Gymnostomum apophysatum* Tayl. in Lond. Journ. Bot., v (1846), p. 43. *Entosthodon Taylori* C. M., Syn., i. 122. *Physcomitrium apophysatum* Wils. in Lond. Journ. Bot., v (1846), p. 448 ; Fl. N.Z., ii, 91 ; Handb. N.Z. Fl., p. 451.

Quite distinct from most of the species in the stout clavate or oval (sometimes slightly pyriform) red-brown capsule, passing into a long tapering collum of quite equal length, the two together nearly always longer than the very short seta, which rarely reaches 7 mm. The peristome is entirely wanting. Leaves cuspidate to subpiliferous, not bordered.

Fairly common ; known also from Australia and Tasmania.

2. **Funaria subattenuata** Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 173 (1898).

Known from all the other species by the erect or suberect clavate capsule with distinctly shorter neck, and the lid, which is highly conical when moist ; and when dry stoutly mamillate or, better, umbonate. The leaves are subobtuse, with large cells and an indistinctly marked border. Seta about 1 cm. Peristome single of short, pale-orange teeth.

Besides the original locality I have it from Mount Ida, Otago, where it was gathered by Mr. Petrie, at 3,000 ft. ; and also from an unlocalized station in the South Island, coll. R. Brown ter. (as *F. glabra*).

3. **Funaria Helmsii** Broth., *op. sit.*, p. 172 (1898).

This and the next species have erect symmetrical capsules, with a neck of almost equal length, which, however, does not taper gradually into the seta as in *F. apophysata*, nor is the seta so short proportionally as in that. The lid is flat when dry, slightly convex when moist. Leaves acute, obtusely serrulate above. Peristome single, similar to the last.

I know of no subsequent gathering since Helms collected it.

4. **Funaria subcuspidata** Broth., *op. cit.*, p. 171 (1898).

Syn. *Meesia craigieburnensis* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 464 (1899).

This species, of which I have seen no specimen, is described by Brotherus as extremely near to *F. Helmsii*, but differing distinctly in the double peristome, the spores coarsely warted, and the lid distinctly convex.

Meesia craigieburnensis R. Br. ter., is a *Funaria* which, so far as I have been able to examine it, agrees exactly with the present species.

5. **Funaria gracilis** (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam. Musci, i, 524 (1903).

Syn. *Entosthodon gracilis* H. f. & W., Fl. N.Z., ii, 91 (1855); Handb. N.Z. Fl., p. 451.

This species and the next are marked by a long seta, 2–3 cm., with a proportionately very small capsule of thin texture, somewhat urceolate when dry; erect and symmetrical with a short, distinct, tapering neck. The leaves are small, crowded into a small comal tuft; they are acutely cuspidate, and entire; in the present species the nerve is excurrent, in an often long, reddish arista.

This species and the following have usually been placed in different genera; and Brotherus, while uniting them in *Funaria*, retains them in distinct subgenera, the present in *Entosthodon* and the next in *Eu-Funaria*. The separation is determined by the fact that while the peristome here is single, in *F. cuspidata* there is an extremely delicate, imperfect inner peristome. In all other respects (barring the nerve of the leaf) the two are extremely close to one another.

F. gracilis is probably frequent, and, like the following, is found in Australia and Tasmania.

6. **Funaria cuspidata** H. f. & W., Fl. N.Z., ii, 91 (1855); Handb. N.Z. Fl., p. 450.

This species differs from the preceding (*q.v.*) only in the presence of an imperfect inner peristome, and in the nerve which, instead of being excurrent, ceases well below the leaf-apex.

It has nearly the same distribution as *F. gracilis*. Paris gives only the North Island; I have seen no records from the South.

7. **Funaria glabra** Tayl. in Lond. Journ. Bot., v (1846), p. 57; Fl. N.Z., ii, 91; Handb. N.Z. Fl., p. 450.

Readily known by the arcuate capsule, with wide mouth and well developed, persistent peristome; the capsule is smooth, not striate, and exannulate, and the seta is shorter than is usual in *F. hygrometrica*, and the capsule smaller.

It appears to be common.

8. **Funaria hygrometrica** (L.) Sibth., Fl. oxon., p. 288 (1794).

Syn. *F. sphaerocarpa* C. M. in Bot. Zeit., 1851, p. 546.

C. Mueller separated the Australasian plant from *F. hygrometrica* on the ground of a shorter and rounder capsule and one or two other characters. If these characters were well defined and constant there might be reason for giving the plant varietal rank at least, but this is not the case; the ordinary forms of *F. hygrometrica* are probably at least equally common in the Australasian region, and they intergrade with the *sphaerocarpa* forms by all transitions.

EXCLUDED SPECIES.

Entosthodon physcomitrioides C. M., " Sudinsel Neuseelands," Gen. Musc. Frond., p. 109—I have examined good specimens of this, det. C. Mueller, in Schimper's herbarium at Kew; the labelling is " In swampy places, Fendalton, near Christchurch, T. W. N. Beckett, No. 367." This is certainly only a robust form of *Physcomitrium conicum* Mitt. C. Mueller writes of it, "welche ganz wie *P. turbinatum* aussieht, aber eine calyptra dimidiata hat." The specimens in Schimper's herbarium have only a single calyptra, but that is not dimidiate, but distinctly that of *Physcomitrium* type. C. Mueller may have been misled by an immature calyptra, or a Funarioid intruder of another species. C. Mueller, by the way, clearly had no intention of relating this to the *Funaria physcomitrioides* Mont. from southern India; the name was duplicated simply through a slip of memory.

BRYACEAE.

The New Zealand genera of this great family may be distinguished by the following key:—

1.	Fruit from base of stem; peristome more or less imperfect ..	*Mielichhoferia.*
	Fruit terminal; peristome mostly well developed	2
2.	Basal membrane of endostome wanting or not reaching above orifice; outer peristome shorter than inner	*Orthodontium.*
	Basal membrane high; outer peristome as long as or longer than inner..	3
3.	Leaves setaceous; cells narrowly linear	*Leptobryum.*
	Leaves (excluding *Pohlia tenuifolia*) wider, ovate-lanceolate, &c.	4
4.	Capsule more or less erect or inclined; processes of endostome usually rudimentary; cilia O	*Brachymenium.*
	Capsule more or less pendulous; processes normal	5
5.	Cells linear or narrowly linear-rhomboid	6
	Cells rhomboid or rhomboid-hexagonal	*Bryum.*
6.	Leaves more or less acute and spreading	*Pohlia.*
	Leaves obtuse or subobtuse, closely imbricate and terete ..	*Anomobryum.*

It should be noted that the distinction between *Bryum* and *Pohlia* is not very clearly defined, and the clause 5 above may be misleading; in *P. albicans*, and to some extent in *P. tasmanica*, the cells are wider and Bryoid.

MIELICHHOFERIA Hornsch. in Bry. Germ., ii, 2, p. 79 (1831).

This genus is a difficult one, as the specific distinctions, while often quite good, mainly depend on peristome characters, so that fruit in good condition is imperative for their proper determination. I do not find any obvious difference between the leaves of the three New Zealand species. The endostome alone is present in the New Zealand representatives of the genus.

KEY TO THE SPECIES.

1.	Basal membrane of endostome reaching conspicuously above rim of capsule	2. *Eckloni.*
	Basal membrane O, or at least not visible above rim	2
2.	Plant tall; leaves rather lax, rigidly patent, not imbricate; seta very fine, 3–4 cm.	1. *tenuiseta.*
	Plant smaller and denser; leaves densely imbricated; seta usually under 2 cm.	3. *australis.*

1. Mielichhoferia tenuiseta Mitt. in Hook. f., Handb. N.Z. Fl., p. 750 (1867).

Syn. *M. longiseta*, *op. cit.*, p. 437, *non* C. M.

Mitten in the above work recognized certain differences, principally of peristome, in the New Zealand plant from the South American *M. longiseta*, and described the former, in the Appendix, as *M. tenuiseta*. It is, according to the few specimens I have seen, a much larger, laxer plant than the other two species, with loosely set spreading leaves and very delicate long seta. I cannot detect any structural differences in the leaves. The nerve is not actually percurrent (or at least this is often the case) as Mitten describes it, but thins out and disappears a little below the apex. The cells are very narrow, almost or quite linear, and pale. The delicate processes of the endostome are not appendiculate; they are smooth below, papillose above.

Beyond the localities given in the Handbook, I know of it only from a specimen sent me from Otago, by Mr. D. Petrie, which I refer here.

2. **Mielichhoferia Eckloni** Hornsch. in Linn., xv (1841), p. 118.

This species was described from Cape specimens, but has since been recognized as an Australasian plant. Vegetatively it is scarcely distinguishable from the following, having the leaves densely imbricated and almost appressed; the endostome, however, differs markedly from both that and the preceding, having a distinct basal membrane (which, however, may be almost masked by the semi-persistent broad annulus), while the processes are longly appendiculate, sometimes anastomosing.

It appears to be the most frequent species. It was first recorded for New Zealand in Trans. N.Z. Inst., vol. 29, p. 443.

3. **Mielichhoferia australis** Hampe in Linn., vol. 30 (1859–60), p. 626.

Syn. *M. Buchanani* R. Br. ter. in Trans. N.Z. Inst., vol. 31 (1899), p. 443.

Similar to the preceding in habit and vegetative characters, but quite different in fruit. The endostome is without basal membrane; the exothecium cells much darker, smaller and more incrassate, especially towards the orifice; the segments differ from those of *M. tenuiseta* in being more or less nodose and appendiculate.

All three species have some resemblance to *Pohlia cruda* in habit, but the capsule is very different; in *M. tenuiseta* it is inclined, narrowly clavate, and fairly symmetrical; in the present species and *M. Eckloni* it is more or less bent and asymmetric.

R. Brown was quite correct in his conclusion, stated in his careful description of *M. Buchanani*, that it was distinct from the other two New Zealand species. The type specimen in his herbarium, however, agrees entirely with a plant collected by and sent to me by Mr. D. Petrie, from "Rae's Junction, Otago, N.Z., Nov., 1891," which I had already compared with Hampe's type of *M. australis* and found to agree exactly.

I know of no other localities in New Zealand. It is otherwise known only from the mountains of Victoria.

ORTHODONTIUM Schwaegr., Suppl., P. ii, p. 123 (1826).

Orthodontium sulcatum H. f. & W. in Hook. Ic. pl. rar., t. 739B (1841); Fl. N.Z., ii, 81; Handb. N.Z. Fl., p. 436.

The only species. Recognized at once by the long, narrow, linear-setaceous leaves, erect, elliptic capsule, sulcate when dry and empty, the rostellate lid, and delicate peristome.

I have it from two or three stations in the South Island, but it would seem to be rare. It is found also in Australia and Tasmania.

I strongly suspect that *O. sulcatum* will have to be reduced to *O. australe* H. f. & W. (Lond. Journ. Bot., iii, 545 [1844]), from the Falkland Islands, Hermite Island, and Tasmania. The authors of the two species did not think it necessary to compare them with one another, no doubt since in their view *O. sulcatum* differs from all the other species in the furrowed capsule, while *O. australe* is figured (and described by implication) as with smooth capsule. I have examined the types of both species, and if the matter could rest on these alone the two might well stand ; but the matter is quite altered when other specimens are examined. In the original specimens of *O. australe* from the Falkland Islands the young capsules are quite smooth, while the old ones are irregularly plicate, but do not show any trace of the regular ribbing that is characteristic of *O. sulcatum*. There are, however, few or no capsules in good mature condition. Tasmanian specimens in Hooker's collection are very puzzling, and perhaps the best comment on the distinctness of the two plants is to be found in the fact that in herb. Hooker there are certain specimens labelled "*O. sulcatum*" which certainly belong to *O. australe*, and others labelled "*O. australe*" which if the two are to be kept separate must as certainly be referred to *O. sulcatum*. The capsules in fact seem to show all gradations from a smooth surface to a very regularly ribbed and sulcate one. The bulk of the specimens, however, lack capsules in good mature condition, and I do not think the problem can be solved satisfactorily except by study of good material in the field.

O. sulcatum is described and figured as with short, only slightly tapering leaves ; but this is no constant character. Tasmanian specimens of Archer's collecting with highly ribbed capsules have the leaves very narrowly and longly tapering, which is the case also with New Zealand specimens in herb. Kew, coll. Beckett.

Rodway (Tasmanian Bryophyta Mosses) describes both *O. australe* and *O. sulcatum* as with sulcate capsules, separating them by the form of the fruit, oblong in the former, fusiform in the latter ; but there is no difference in the form of the capsule, either as figured by H. f. & W. or as exhibited by the original specimens, except inasmuch as is produced by different stages of maturity.

Brotherus also places both species under the section "Kapsel gerippt, trocken gefurcht," without suggesting any differences.

LEPTOBRYUM Wils., Bryol. Brit., p. 219 (1855).

Leptobryum pyriforme (Linn.) Wils., *op. et loc. cit.*

> Syn. *Bryum piriforme* auctt. plur. ; Handb. N.Z. Fl., p. 438. *Leptobryum Harriottii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 444 (1899). *Bryum Cockaynei* R. Br. ter., *op. cit.*, p. 456.

An almost cosmopolitan species, known at once by its silky setaceous leaves, and its small, highly glossy, turgidly piriform capsule of thin papery texture. Several forms have been separated off as species, of which *L. Harriottii* is one, but the specimens in Brown's herbarium do not warrant specific, or even, I think, a varietal name. *Bryum Cockaynei*, in Brown's herbarium, is also a starved form of this species.

It occurs commonly ; a very frequent denizen of pots in greenhouses, to which probably it owes some at least of its wide distribution.

POHLIA Hedw., Descr., i. p. 96 (1787); Lindb., Musc. Scand., p. 17 (1879).
Syn. *Webera* Hedw., Fund., ii, 95 (1782).

A genus not easy to separate from *Bryum* by well-defined characters, but in practice not difficult to recognize; the narrow areolation (except in *P. albicans*), usually narrow leaves, cilia of endostome not distinctly appendiculate, &c., being usually marked and distinctive.

I have included two species, *P. albicans* and *P. tasmanica*, separated by recent authors under *Mniobryum*, a genus which scarcely seems to me sufficiently distinct to be retained. *P. Binnsii* also belongs to this group.

KEY TO THE SPECIES.

1.	Leaves narrowly linear-subulate, with long, finely tapering, flexuose points	1. *tenuifolia.*
	Leaves ovate to lanceolate, not longly acuminate	2
2.	Robust; leaves 3–5 mm. long, when dry glossy, with an almost iridescent sheen	2. *cruda.*
	Much smaller, or, if robust, leaves not or slightly glossy	3
3.	Tall, soft plant; leaves ovate-lanceolate, margin plane; cells lax, pellucid, thin-walled (about 5–6 × 1)	6. *albicans.*
	Leaves narrower, lanceolate; cells much narrower	4
4.	Cells linear, subvermicular	5
	Cells wider, linear-rhomboid, pellucid	6
5.	Capsule ovoid, neck short; paroicous	3. *nutans.*
	Capsule subcylindric, neck almost equalling the sporangium; dioicous	5. *novae-seelandiae.*
6.	Dioicous; nerve ceasing below apex	7. *tasmanica.*
	Synoicous or paroicous; nerve percurrent or shortly excurrent	4. *nutanti-polymorpha.*

1. Pohlia tenuifolia (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 549 (1903).

Syn. *Bryum tenuifolium* H. f. & W. in Lond. Journ. Bot., iii (1844), p. 546; Fl. N.Z., ii, 83; Handb. N.Z. Fl., p. 441. *B. Walkeri* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 457 (1899). *B. Whittonii* R. Br. ter., *op. cit.*, vol. 35, p. 334 (1902). *B. Barrii* R. Br. ter., *op. et loc. cit.*

Very distinct from all the remaining species in the leaves, longly and narrowly linear-subulate, entire. The capsule is very small, narrowly oval, from horizontal to subpendulous, the seta very slender; peristome pale yellow, processes of endostome finely papillose, scarcely split; cilia variable, often rudimentary.

Orthodontium sulcatum, somewhat similar in the foliage, differs at once in the capsule.

No specimens of *B. Walkeri* or *B. Whittonii* occur in Brown's herbarium, but the descriptions and figures leave little or no doubt that they belong to this species, as does also *B. Barrii*, from type specimen.

It occurs in both Islands, and is probably not uncommon. It is recorded from one locality in New South Wales, but otherwise is unknown outside New Zealand.

2. **Pohlia cruda** (L.) Lindb., Musci Scand., p. 18 (1879).

> Syn. *Bryum crudum* Huds., Fl. Angl., p. 491 (1778); Handb. N.Z. Fl., p. 440.

An almost cosmopolitan moss in temperate regions, and a very beautiful one, often forming large dense tufts with stems 1–2 in. high, the leaves glistening with an almost iridescent sheen rarely found in mosses; the leaves are large, the lower ovate-lanceolate, the comal much narrower and longer; capsule large, cylindrical-oblong. It is a plant of the mountains, and no doubt of frequent occurrence, though I have not seen it from the North Island.

3. **Pohlia nutans** (Schreb.) Lindb., Musci Scand., p. 18 (1879).

> Syn. *Bryum nutans* Schreb., Spic. fl. Lips., p. 81 (1771); Handb. N.Z. Fl., p. 440. *B. torlessense* R. Br. ter., in Trans. N.Z. Inst., vol. 31, p. 458 (1899).

Another equally cosmopolitan and even commoner species, and at the same time a far more variable one than *P. cruda*; but quite easily recognized, among the New Zealand plants at least, by the narrow leaves, the narrow linear, rather dense areolation, the paroicous inflorescence, and the form of the capsule. There is especially much variability in the length of the seta, and the following form perhaps deserves varietal rank:—

Var. **longiseta** Huebn.

> Syn. *Bryum bealeyense* R. Br. ter., in Trans. N.Z. Inst., vol. 31, p. 457 (1899).

In marshes, often with the type, and usually showing a great variability in the length of the seta, so that it is difficult to fix the limits of the variety: it may reach 5–6 cm.

4. **Pohlia nutanti-polymorpha** (C. M.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 547 (1903).

> Syn. *Bryum nutanti-polymorphum* C. M. in Hedwig., vol. 37, p. 86 (1898).

I have not seen this species, but from the description it should be quite distinct from *P. nutans* in the small size, rather lax and pellucid cells, and the minute clavate-oblong capsule with very delicate endostome and rudimentary cilia. C. Mueller describes it as synoicous; Brotherus places it under the paroicous species.

5. **Pohlia novae-seelandiae** Dixon in Bull. Torr. Club, 42, 102, t. 9, fig. 8 (1915).

This species is fully described in the above work; it differs from all the others but *P. tenuifolia* in the narrow, cylindrical capsule, inclined or horizontal, not nodding, with neck of about equal length; the dioicous inflorescence separates it from all the preceding (except *P. tenuifolia*). *P. tenuifolia* has quite different leaves and much smaller and shorter capsule.

Subgen. MNIOBRYUM Schimp.

6. **Pohlia albicans** (Wahl.) Lindb., Musci Scand., p. 19 (1879).

> Syn. *Bryum Wahlenbergii* Schwaegr., Suppl., i, P. ii, p. 92 (1816); Handb. N.Z. Fl. p. 439.

This is another species of similarly wide distribution with the two above. It is usually readily known by the soft texture, very pale green, whitish, wide leaves with very pellucid wide cells, the nerve ceasing decidedly below the apex (this character will separate it also from species of *Bryum*). The capsule, when present (it is a dioicous species and is not commonly found fruiting) is very short and small for the size of the plant, often when deoperculate almost as broad as long) and of somewhat fleshy texture. The male flower is large, discoid, and conspicuous.

It appears to be frequent, but less so in the northern parts of the group than the southern.

7. **Pohlia tasmanica** (Broth.) Dixon comb. nov.

> Syn. *Mniobryum tasmanicum* Broth. in Oefv. af Finska Vet.-Soc. Foerh., xxxv, 48 (1893). *Bryum Binnsii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 456 (1899).

A very pretty species, especially when (as is usually, perhaps, the case) the whole plant is coloured a deep vinous red. Most of the specimens I have seen are the male plant, with the flowers discoid and conspicuous as in *P. albicans*, which is a much larger and very different plant.

The cells, although very narrow as compared with those of *P. albicans*, are wide as compared with all the other species (except probably *P. nutanti-polymorpha*), and are pellucid and thin-walled.

Bryum Binnsii R. Br. ter. must be referred here, though the leaves on the main stems are slightly wider and less finely-acuminate. It is a tall form (7 cm.) of the bright rose colour frequent in the species, with the leaves laxly disposed and often secund. It is the fruiting plant, but the specimen preserved in Brown's herbarium unfortunately has only old setae left. These are about 1 in. long ("¼ in." in Brown's description is clearly a misprint). From the description and figures the capsule probably differs somewhat from that of *P. albicans*.

Brown records it from Stewart Island, and from Dunedin, where it was collected by Miss E. W. Blackwell in 1904 (Nos. 12, 13). I have it from Kaipara, north of Auckland, North Island, and from Mount Cook district in the South Island (coll. James Murray, 1907); but I do not know of any other New Zealand records beyond those given by R. Brown for *B. Binnsii*. It was first described from Tasmania, and has no wider distribution.

BRACHYMENIUM Schwaegr., Suppl., ii, P. i, p. 131 (1823).

Distinguished from *Bryum* principally by the fruiting characters, the capsule being erect or inclined, rarely horizontal or pendulous, the mouth small; while the inner peristome is imperfect, consisting of a more or less elevated membrane, and processes which may be fairly developed or entirely rudimentary or wanting, without cilia.

Brachymenium Preissianum Hampe, Icones musc., t. 25 (1844).

Syn. *Brachymenium coarctatum* Hook. f., Handb. N.Z. Fl., p. 437 (nec *B. coarctatum* (C. M.) Bry. jav., i, 312).

A small plant with densely tufted stems, Bryoid foliage with small leaves having stout excurrent nerve, and capsule suberect or somewhat inclined, deep red, ovate, widest near base and gradually narrowed above, with small mouth and highly conical narrow lid (this is frequently abnormally elongate and rostellate).

It is the *Brachymenium coarctatum* of the Handb., but not of the Bry. javanica. I have examined the specimen in the Kew collection on which the above record (by Mitten) is based. It is a scrap only, with two capsules, and it is noted that it comprises all the material that Mitten had. Although extremely near to *B. coarctatum*, it differs in well-defined characters. The leaf-cells are uniformly denser, shorter, more incrassate (in *B. coarctatum* they are very thin-walled); and the peristome shows marked differences. In the Javan plant the outer teeth are narrow, so that the spaces between the teeth at base are about equal to the width of the base of the tooth; the endostome membrane is about half the height of the teeth, with extremely rudimentary processes when at all present.*

In *B. Preissianum* Hampe the teeth are broad at the base and nearly meet; the basal membrane of endostome is not much more than a quarter the height of the teeth, and the processes are well developed, narrow-linear, scarcely split, approaching the height of the outer teeth.

Mr. D. Petrie has sent me abundant specimens of this moss from near Auckland, and also from the neighbourhood of Oamaru; while Mr. Gray has sent it from Mauriceville, in the North Island. It would seem, therefore, not to be infrequent, but it does not appear in our national collections, with the exception of the specimen referred to above. Its further distribution is Tasmania and Australia; herbarium specimens under this name from South Africa belong to other species.

ANOMOBRYUM Schimp., Syn., ed. i, p. 382 (1860).

Differs from *Bryum* in the habit, the leaves being small, closely imbricated, and usually julaceous, often cymbiform and obtuse, with very narrow often vermicular areolation.

Anomobryum Harriottii (R. Br. ter.) Dixon comb. nov.

Syn. *Bryum Harriottii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 453 (1899). *Anomobryum densum* Dixon in Bull. Torr. bot. Club, 42, 103 (1915).

I described and figured this species in the above work, and need not do more than refer the student to it. From an examination of the types of R. Brown's species of *Bryum* I now find that it has been already described by him as *B. Harriottii* (I am unaware of the significance of the specific name, but presume it has a personal reference). It is a form with a larger capsule than the plant I first described as *A. densum*. I detected a somewhat similar form in a tuft of *B. curvicollum* Mitt., also collected by Brown, January, 1900, on Mount Torlesse, where, however, the capsule, though longer, was less turgid ; except in this respect all the plants agree exactly.

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* The Bry. jav., tab. cxv, fig. 28, figures the teeth as broad at the base, but I am inclined to doubt the accuracy of this drawing. I have examined a peristome in good condition from "Java" in herb. Schimp., which is, no doubt, an original specimen. Fleischer, moreover, describes the teeth as distant. The Bry. jav. figure also shows the basal membrane much more than half the height of the teeth, contrary to the description in the text and in C. M. Synopsis, where they are described as half the height of the teeth, which agrees with my observation. (Fleischer, however, describes it as three-quarter the height: this may be derived from the above figure, or there may be some variation in its height.)

The known habitats are as follows : Wet banks near the Weka Pass, April, 1882 ; Mount Torlesse, January, 1900 ; Gorge of the Waimakariri River, on wet rocks, January, 1900 (*Bryum* sp. nov. in herb. R. Brown) : all collected by R. Brown. Paparoa Range, South Island, 1885 and 1888, coll. R. Helms.

A. Harriottii is the only known species of the genus in the Australasian region, with the exception of *A. cymbifolium* (Lindb.) Broth., which was collected in North Queensland in 1913 by the late Rev. W. W. Watts. It cannot easily be mistaken for anything else.

BRYUM Dill. emend. Schimp., Syn. (1860).

Some eighty or ninety names have been found for the various New Zealand forms of this, the largest genus of mosses. Out of this welter of names it seemed at first hopeless to evolve any practical and yet natural arrangement ; but a study of the plants themselves led to a more hopeful outlook, primarily because it became at once evident that in the case of two or three of the species one had to do with very plastic types, and it was out of these that the larger number of the "specie " had been formed. Pre-eminently was this the case with the species listed below as *B. bulbillosum* Mont., *B. curvicollum* Mitt., and *B. chrysoneuron* C. M., and to a less extent with *B. pachytheca* C. M. and *B. truncorum* Brid.

The variability is mostly confined to the vegetative organs, so much so in several cases that I believe it is scarcely possible to distinguish some of the above species except by the fruit. If due heed be given to the fruiting characters in these cases, I believe that the difficulties inherent in the genus will be found immensely reduced, and that the grouping here adopted (as employed by Brotherus in the "Musci"), together with the key, will render the determination of the species a matter of no very great difficulty with specimens in good mature fruit—and this is in most Brya a *sine qua non*.

The present arrangement consists of twenty-five species.

The inflorescence is an important character in most of the species, although in one or two species it is inconstant and unreliable.

The most modern arrangement, perhaps, of *Bryum* (that followed in the "Musci") divides the genus into two sections : (1) Ptychostomum, the main characters of which are that the inner layer of the outer teeth of the peristome is not furrowed or perforated, and has the lamellae connected with one another on the ventral surface by irregular bands, while the endostome is usually more or less adherent to the outer teeth, the cilia are without appendages and are frequently rudimentary or wanting ; (2) Bryotypus, in which the inner lamellae of the outer teeth are not connected together. This section is divided into two subsections : (*a*) Cladodium, with the cilia not appendiculate, often rudimentary (very rarely appendiculate), the endostome often adherent, and the inner layer of the outer teeth sometimes furrowed or perforated ; (*b*) Eu-bryum, with the cilia nearly always appendiculate, and the endostome free.

A large proportion of the species of *Bryum* of the North Temperate Zone belong either to the section Ptychostomum or to the subsection Cladodium of Bryotypus: but of the New Zealand species none belong to Ptychostomum, and only one (*B. mucronatum*) to Cladodium. All the others belong to the various groups of the subsection Eu-bryum. It will perhaps be most convenient to summarize here the main characters of the groups, always premising that they do not admit of rigid definition, but rather consist of a group of characters not all of which can be relied on to be present in all the species of a group, but on the whole most readily to be recognized by the general facies of the plants.

That the greater number of Brown's new species would have to be dropped was perhaps to be expected in view of the difficulties of the genus, and the fact that he was not well acquainted with many of the already described species.

Sec. BRYOTYPUS.

Subsec. *Cladodium.*

1. Cernuiformia.

Autoicous or synoicous. Nerve ceasing at or near apex, or shortly excurrent only. Capsule asymmetric, the sporangium being usually gibbous and the neck curved. Outer teeth not transversely striolate; cilia imperfect.

B. mucronatum.

Subsec. *Eu-bryum.*

Outer teeth often finely transversely striolate; inner free; cilia appendiculate (except sometimes in *B. curvicollum*).

2. Pseudotriquetra.

Male flower capitulate to subdiscoid. Usually robust, rather loosely tufted plants with elongate stems, with the leaves not markedly comose. Leaves mostly decurrent, shrunken and twisted when dry, acuminate; nerve usually more or less excurrent. Capsule elongate, symmetric. Seta usually long.

B. bimum; B. affine; B. austro-pallescens.

3. Caespitibryum.

Male flower gemmiform. Plants usually small, in dense tuft with short stems; the leaves densely comose, not decurrent, not spirally twisted when dry, acuminate; nerve generally excurrent. Capsule rather small, pale brown or reddish-brown.

B. austro-bimum; B. caespiticium.

4. Argyrobryum.

Small dense plants, usually silvery with the long hyaline leaf-points. Capsule usually short and wide, small.

B. argenteum.

5. Doliolidium.

Dioicous; male flower gemmiform. Small plants in dense tufts, usually readily falling apart (not tomentose); innovations usually densely and equally foliate, with small, short, not comose leaves. Nerve stout, often excurrent as a stiff cuspidate point. Seta mostly short. Capsule small, short and thick, neck short or quite wanting.

B. dichotomum; B. pachytheca.

6. Erythrocarpa.

Dioicous; male flower gemmiform. Moderate-sized, rather slender plants, with loose, not tomentose stems; innovations elongate, equally, rather loosely foliate; leaves often reddish, shrunken when dry; nerve less stout. Seta longer; capsule usually purple-red when ripe, narrower, with a distinct tapering neck.

B. chrysoneuron, subsp. *luteo-limbatum.*

7. Alpiniformia.

Dioicous ; male flower gemmiform. Moderate-sized plants in dense tufts, often reddish, glossy ; leaves not comose, dense, rather rigid, when dry appressed, scarcely shrunken or twisted, concave. Seta moderately long, capsule often purplish-red.

B. blandum ; B. curvicollum ; B. laevigatulum ; B. crassum ; B appressifolium.

8. Trichophora.

Dioicous or synoicous ; male flower gemmiform. Rather low plants of soft texture ; leaves more or less comose, weak, more or less appressed or spirally twisted when dry, broad above and not or slightly acuminate ; nerve usually excurrent in a long flexuose hair-point. Capsule of moderate size, narrow, brown, or deep red.

B. obconicum ; B. torquescens.

9. Rosulata.

Robust plants with usually large leaves often comose, broad above, often strongly bordered ; nerve usually stout, ceasing at or below apex or shortly excurrent. Capsule narrow, usually large and long-necked. Mostly dioicous.

B. Billardieri ; B. campylothecium ; B. truncorum ; B. laevigatum ; B. incurvifolium ; B. Huttonii ; B. eximium.

Key to the Species.

1.	Capsule (with neck) curved and asymmetric ; cilia imperfect	2
	Capsule rarely curved or asymmetric ; cilia (excluding *B. laevigatulum* and *B. curvicollum*) appendiculate	3
2.	Capsule with markedly curved neck, large ; cilia imperfect, not appendiculate ; leaves wide, shortly pointed, with very wide cells ; bordered	*B. mucronatum*
	Capsule slightly curved ; leaves rather small, not bordered ; cells small and more or less opaque	*B. curvicollum.*
3.	Leaves with silvery points	*B. argenteum.*
	Leaves not silvery	4
4.	Leaves when dry spirally twisted round stem	*B. torquescens.*
	Leaves not spirally twisted (rarely in *B. obconicum*)	5
5.	Ripe capsule deep purple-red	6
	Capsule brown (except *B. appressifolium*)	10
6.	Tall robust plants ; leaves all reddish, not shrunken when dry, concave, very obtuse, nerve ceasing below apex ; cells lax	*B. blandum.*
	Plants smaller and more slender, with different foliage	7
7.	Capsule narrow, with a distinct neck tapering gradually into the seta	8
	Capsule short and thick, neck very short or none	9
8.	Leaves not or scarcely bordered	*B. chrysoneuron.*
	Leaves distinctly bordered	*B. luteo-limbatum*
9.	Capsule with a corrugated base, not tapering at all	*B. pachytheca.*
	Capsule-neck not distinctly corrugated when mature, short, tapering rapidly into the seta	*B. dichotomum.*
10.	Leaves soft ; nerve excurrent in a longish flexuose hair-point	*B. obconicum.*
	Leaves mostly firmer ; arista short or 0, or if longer not markedly flexuose ; stoutish	11
11.	Inflorescence autoicous	*B. austro-pallescens*
	Inflorescence synoicous	12
	Inflorescence dioicous	13
12.	Nerve only shortly excurrent ; leaves acute to acuminate	*B. bimum.*
	Nerve rather longly cuspidate ; leaves acuminate	*B. affine.*
13.	Leaves small, 1–2 mm. long, mostly finely acuminate	14
	Leaves large, 2–4 mm. or more, shortly and widely pointed	19

14.	Leaves widely oval, very acuminate, cells pellucid, lax, border distinct, in 1–3 rows; seta very short	*B. austro-bimum.*
	Leaves narrow, acute to acuminate	15
15.	Leaves finely acuminate, nerve longly excurrent, margin recurved	16
	Leaves less narrowly acuminate, nerve not longly excurrent	17
16.	Capsule clavate, gradually tapering to neck	*B. caespiticium.*
	Capsule turgid, abruptly narrowed to neck, wide-mouthed	*B. appressifolium.*
17.	Leaves widely pointed, very concave, margin erect	18
	Leaves acuminate, margin recurved	*B. crassum.*
18.	Neck of capsule often curved, spores 20–25μ	*B. curvicollum.*
	Neck of capsule not curved, spores 15–17μ	*B. laevigatulum.*
19.	Leaves in distinct comal or rosulate tufts	20
	Leaves not or not markedly comose	21
20.	Leaves when moist widely spreading, more or less flexuose when dry, widely bordered	*B. truncorum.*
	Leaves when moist suberect, closely appressed and not twisted when dry, not or very indistinctly bordered	*B. campylothecium.*
21.	Nerve distinctly excurrent	*B. Billardieri.*
	Nerve not or very shortly excurrent, leaves very concave	22
22.	Very tall marsh-plants with very large leaves, widely spreading and laxly set	*B. eximium.*
	Leaves erecto-patent, densely set	23
23.	Leaves scarcely bordered, margin nearly plane	*B. incurvifolium.*
	Leaves rather markedly bordered, margin mostly recurved	24
24.	Leaves widely ovate	*B. laevigatum.*
	Leaves larger, longer, oblong-ovate	*B. Huttonii.*

Subsec. *Cladodium.*

1. Cernuiformia.

1. **Bryum mucronatum** Mitt. in Handb. N.Z. Fl., p. 442 (1867).

Syn. *B. obesothecium* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 459 (1899).

A very distinct species, closely allied to the European *B. uliginosum* Bry. eur. (*B. cernuum* Lindb.), and readily known by the tall lax habit, long seta, cernuous long-necked capsule, with peristome of *Cladodium;* the leaves too are distinct, widely ovate-oblong, very shortly pointed, the nerve scarcely reaching apex, the cells wide and pellucid, with a very marked border of narrow cells; and the synoicous inflorescence. Brotherus questions this, stating that the specimens he has are autoicous. I have examined the type, however, and confirmed Mitten's diagnosis. Moreover, a specimen received from Mount Pisa, Central Otago (coll. D. Petrie), determined as *B. mucronatum* by Brotherus, has leaves much more tapering than in *B. mucronatum*, and quite different capsule. I suspect, therefore, that Dr. Brotherus had not the true plant of Mitten before him when writing the above remark. *B. obesothecium* R. Br. ter agrees exactly with Mitten's plant.

This endemic species appears to have been found only in the central districts of the South Island.

Subsec. *Eu-Bryum*.

2. Pseudo-triquetra.

2. **Bryum bimum** Schreb., Spic. fl. lips., p. 83 (1771); Fl. N.Z., ii, 85; Handb. N.Z. Fl., p. 441.

An almost cosmopolitan species in the Temperate Zones, and some of the alpine regions of the warmer regions of the world. It is not difficult to recognize, from the synoicous inflorescence, generally tall and lax habit, and the leaves more or less flexuous when dry, only shortly acuminate, with the nerve only shortly excurrent, the cells rather small for the size of the leaf, the distinct border of 4–6 narrow incrassate cells, and the leaf-margin, at least in the lower part, strongly recurved.

It is probably common, growing in wet places.

3. **Bryum affine** (Bruch) Lindb., Musc. Scand., p. 16 (1879).

Syn. *Webera affinis* Bruch. *e* Brid., Bryol. univ., i, 848 (1826). *Bryum cuspidatum* Schimp., Syn., ed. ii, p. 430 (1876). *B. creberrimum* Tayl. in Lond. Journ. Bot., v, 54 (1846); Fl. N.Z. ii, 84; Handb. N.Z. Fl., p. 442; (*p.p.*). *B. tasmanicum* Hampe in Linn, xxv, 714 (1852). *B. Gibsonii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 448 (1899). *B. cuneatum* R. Br. ter., *op. cit.*, p. 459. ? *B. Foresterii* R. Br. ter., *op. cit.*, vol. 35, p. 334 (1902).

This plant is perhaps better treated, as by Lindberg and other authors, as a subspecies of *B. bimum*, from which it differs only in the narrower, more finely acuminate leaves with more longly excurrent nerve, and the somewhat laxer cells with thinner walls. It is also usually shorter and less robust.

I have carefully examined the specimens of *B. creberrimum* in the herbaria of Hooker and Wilson. Hooker's specimens contain an undoubted mixture, some being the true *B. creberrimum* of Taylor—*i.e.*, *B. affine*—but others as certainly *B. obconicum*. It is, principally at least, on these latter that the description in the Handbook is drawn up, thus accounting for the species being there described as dioicous. Wilson in his notes on *B. creberrimum* appears to have fallen into the same error; he refers to it *B. australe* Hampe, but, I think, incorrectly. He states that he has not found the Swan River plant (*i.e.*, the original of *B. creberrimum* Tayl.) constantly synoicous, writing "In some cases assuredly monoicous; in others I see flowers hermaphrodite." This may probably be due to a mixture undetected by Wilson, but is more likely to indicate a heteroicous condition, such as occasionally occurs in allied species—*e.g.*, *B. pallescens*. On the other hand, I have no hesitation in referring *B. tasmanicum* Hampe here. The description could not have been apter if it had been intended to apply to *B. affine*; and Hampe's type specimen appears to me identical in every way with *B. affine*.

B. Foresterii R. Br. ter. is represented in Brown's herbarium by a starved burnt-up plant with only two imperfect overripe capsules. It might be referable here; the description and figures would quite admit it, only the species is described as "monoecious." But in other cases Brown employs this term where the plant is really synoicous, and this may be the case here.

The other two species placed in the synonymy certainly belong here, from an examination of Brown's type specimens.

B. affine is probably quite as frequent as *B. bimum.*

4. **Bryum austro-pallescens** Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 178 (1898).

Syn. *B. Maudii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 460 (1899).

This plant is distinguished by its autoicous inflorescence, the rather tall and laxly foliate stems, with the leaves somewhat contracted and twisted when dry, the wide border and strongly recurved margin, longly excurrent nerve, long seta (up to 4 cm.), &c.

B. Maudii R. Br. ter. is the same thing. It is a plant of marshy ground. It was also gathered in the Mount Cook district by Mr. James Murray in 1907.

3. Caespitibryum.

5. **Bryum caespiticium** L., Sp. Pl., p. 1121 (1753); Handb. N.Z. Fl., p. 442.

Syn. *B. cylindrothecum* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 452 (1899).

I have no doubt that the specimens so named by Wilson belong to this species, and I have seen several other specimens referable here, including the type of *B. cylindrothecum* R. Br. ter.

It has the densely tufted habit characteristic of the group, and is usually fairly easily recognized by this and the densely crowded leaves, erect and little altered when dry, narrowly acuminate with strongly recurved, narrowly bordered leaves, and longly excurrent nerve. The dioicous inflorescence will separate it from small forms of the last species, the pale brown (not red or purple) capsule from most of the species of the same habit. *B. austro-bimum* Broth. is the nearest to it, with the same habit and similar fruit, but has decidedly wider leaves with shorter points, the nerve stout and red at the base.

6. **Bryum austro-bimum** Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 177 (1898).

I have received from Dr. Brotherus a part of the type gathering of this, which appears to be a quite distinct though not strongly marked species, very nearly allied to *B. caespiticium*, but distinguished by the characters given above. I know of only one other record besides the original one from Mount Alfred, coll. W. Bell. This is a plant in Hooker's herbarium at Kew, determined as *B. caespiticium*, var., "N. Zealand, Colenso, 4665, Hb. Hook."

4. Argyrobryum.

7. **Bryum argenteum** L., Sp. Pl., p. 1120 (1753); Handb. N.Z. Fl., p. 441.

It is scarcely necessary to describe this well-known and cosmopolitan moss, which cannot be mistaken for any other species.

5. Doliolodium.

8. **Bryum pachytheca** C. M., Syn., i, 307 (1849): Handb. N.Z. Fl., p. 443.

Syn. *B. kirkii* Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 179 (1898). *B. triangularifolium* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 451 (1899).

This widely distributed species in Australasia is known at once from all its congeners by the capsule, which is turgidly elliptic or barrel-shaped with a short conical lid, with no tapering neck: the base of the capsule passes abruptly into the seta, and is when ripe and dry corrugated, often slightly wider than the sporangium, so that the whole bears no slight resemblance to an acorn in its cup; the capsule when properly matured is a deep purple-red.

The leaf does not show any marked difference from that of the following species. The margin is not always plane as usually described: it may be slightly revolute on some leaves and plane on others of the same stem. *B. Kirkii* Broth., founded principally or entirely on vegetative characters, appears to me inseparable from *B. pachytheca*.

Brachymenium Preissianum may perhaps be liable to be taken for it, but that has a distinct and tapering neck, though short and somewhat corrugated, and the lid is much higher and shortly rostellate.

Some forms of the following species with short, starved capsules come near it, but they always show some trace, however short, of the tapering neck, which is rarely distinctly corrugated as here, and I am not aware that bulbils have been found in the present species.

9. **Bryum dichotomum** Hedw., Sp. M., p. 183, t. 42 (1801); Fl. N.Z., ii, 85.

Syn. *B. bulbillosum* Mont. in Ann. Sc. Nat., xvi (ser. ii), p. 268 (1839). *B. annulatum* H. f. & W., Fl. Antarct., i, 134 (1844); Fl. N.Z. ii, 84; Handb. N.Z. Fl., p. 443. *B. atropurpureum* Hook. f., Fl. N.Z., ii, 84, *et* Handb. N.Z. Fl., p. 443 (nec *B. atropurpureum* W. & M.). *B. Belli* C. M. in Hedwig., vol. 37, p. 93 (1898). *B. oamaruanum* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 447 (1899). *B. waikariense* R. Br. ter., *op. cit.*, p. 448. *B. otahapaense* R. Br. ter., *op. et loc. cit.* *B. ovatothecium* R. Br. ter., *op. cit.*, p. 449. *B. Webbii* R. Br. ter., *op et loc. cit.* *B. Petriei* R. Br. ter., *op. cit.*, p. 450. *B. ovatocarpum* R. Br. ter., *op. cit.*, p. 451. *B. ovalicarpum* R. Br. ter., *op. et loc. cit.* *B. Webbianum* R. Br. ter., *op. cit.*, p. 452. *B. Theriotii* R. Br. ter., *op cit.*, vol. 35, p. 335 (1902).

The above long list of synonyms is mostly due to a considerable degree of variability in the capsule form, and in a much greater degree in the vegetative characters. The latter indeed vary so greatly that I do not think any reliance can be placed on them beyond the general character as distinct from the species of other groups. The capsule in its normal form, and well developed, is quite distinct (*cf.* fig. 9*a*), and easily recognizable; it is small, on a short seta, reddish-brown, but not of such a deep or bright red as *B. pachytheca* or *B. chrysoneuron*. It has a very short but distinct neck, tapering into the seta, which is arcuate from the point where it joins the capsule; the broader part of the collum is usually slightly corrugated; the capsule is shortly and turgidly elliptic or barrel-shaped, usually broader at the point where it is joined by the neck than above, and indeed is frequently narrowed above, and especially below the orifice, more particularly in capsules gathered before the fall of the lid and therefore not perfectly mature. The lid is very shortly and broadly conical, usually obtuse, and paler than in *B. pachytheca.*

Abnormal forms of the species, of which the type figured by Hedwig is one, have the capsule very short, sometimes as broad as long, and the neck reduced to the smallest dimensions. In such cases, however, some capsules will show distinct traces of neck, sufficient to distinguish it from *B. pachytheca.*

Minute axillary bulbils, oblong, crowned with rudimentary leaf-apices, are frequent among the upper leaves. Correns describes and figures from the South American *B. bulbillosum* Mont. a somewhat different form of bulbil from that prevalent in the New Zealand plant, which is similar to that of *B. atropurpureum*, and for that reason the species have been considered distinct, contrary to Mitten's view in the Musci Austro-americani. However, I have recently examined original specimens of Montagne's plant, and find the bulbils exactly similar to those of the Australasian species, and it must be considered that either Correns was dealing with a different plant or that two forms of bulbil occur. In any case I have no doubt that Mitten is correct in referring *B. bulbillosum* to *B. dichotomum*. Without doubt, too, some of the related Australian species will have to be reduced to *B. dichotomum.*

I have examined Wilson's specimens of *B. annulatum*, and have no hesitation in referring it here also; the differences relied on—the recurving of the leaf-margin, the form of capsule, &c.—are unreliable.

I have examined specimens of all Brown's species referred above to *B. dichotomum* except *B. oamaruanum* and *B. Theriotii*, as to which the descriptions and figures leave scarcely a doubt as to their identity with it.

B. Bellii C. M. at Kew is simply a not-uncommon form of *B. dichotomum.*

6. Erythrocarpa.

10. **Bryum chrysoneuron** C. M. in Bot. Zeit., 1851, p. 549; Handb. N.Z. Fl., p. 443.

> Syn. *B. duriusculum* H. f. & W., Fl. N.Z. ii, 84 (1855); *B. erythrocarpoides* Hampe & C. M. in Linn., xxvi, 495 (1853). *B. erythrocarpoides* Schimp. *e* Besch. in Ann. Sc. Nat., xviii (ser. 5), p. 214 (1873). *B. Bescherellei* Jaeg., Adumbr., i, 627.

In Journ. Bot., lvii, 78 (1919) I made some remarks upon *B. erythrocarpoides* Schimp., &c., showing that these could not be separated from *B. erythrocarpoides* Hampe & C. M. I have since found by comparison with *B. chrysoneuron* that they are also identical with this, which must have the priority. I am far from claiming to have reached finality with this. As the Handbook says, the New Zealand plant is very closely allied to the European *B. erythrocarpum*; but there are some differences in the vegetative parts which seem to me to make it, at present at least, inadvisable to unite them.

B. chrysoneuron is readily known by the soft narrow leaves, often of a reddish colour, scarcely or not bordered, and with a usually stout, red, more or less excurrent nerve; and especially by the capsule, which, like that of the previous group, is of a deep purple-red when ripe, but, unlike that, is narrowly clavate, tapering very gradually into the seta by a much longer neck. Like *B. dichotomum* it varies greatly in the vegetative organs, and the varieties of the Fl. N.Z. are perhaps hardly worth maintaining. It is a frequent species.

Subsp. **B. luteo-limbatum** Broth. in Proc. Linn. Soc. N.S.W., xli, 589 (1916).

From the description this appears to differ from *B. chrysoneuron* in the leaves being bordered by three rows of yellowish, narrow cells. It would appear to bear much the same relationship to *B. chrysoneuron* that *B. marginatum* Mitt. does to *B. erythrocarpum*; and I have thought it best to treat it as a subspecies. Unfortunately, I have been unable to study the plant; Dr. Brotherus informs me that his single capsule was used for the diagnosis, and the small tuft which he kindly sent me belongs indubitably to *B. curvicollum*, and cannot therefore be the plant described.

It was collected near Auckland by D. Petrie.

7. Alpiniformia.

11. **Bryum blandum** H. f. & W. in Lond. Journ. Bot. iii, 1844, p. 546; Fl. N.Z., ii, 83; Handb. N.Z. Fl., p. 441.

A very beautiful and distinct species, as the absence of synonymy indicates. It forms deep, dense tufts sometimes 3–4 in. high, of a bright-reddish colour, sometimes variegated with yellowish-green in the young leaves, and occasionally altogether of a lurid green colour; the leaves are suberect, little altered when dry, oblong, very obtuse, with the nerve ceasing just below the apex; the border erect, the cells rather wide, with a broad border of extremely narrow ones.

It is a plant of marshy ground, not uncommon, and known from Campbell Island, and also from Tasmania.

12. **Bryum curvicollum** Mitt. in Handb. N.Z. Fl., p. 442 (1867).

> Syn. *B. clavatum* H. f. & W., Fl. N.Z., ii, 84 (1855) (nec *B. clavatum* (Schimp.) C. M., Syn., i, 292 (1849)). *B. varians* C. M. in Engl. Bot. Jahrb., v, 87 (1883), and Forsch. S. M. S. Gazelle, iv, Bot., p. 60 (1889). *B. Levieri* C. M. in Hedwig., vol. 37, p. 92 (1898). *B. ventricosum* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 454 (1899). *B. Bellianum* R. Br. ter., *op. et loc. cit.* *B. hapukaense* R. Br. ter., *op. cit.*, p. 455. *B. heterofolium* R. Br. ter., *op. cit.*, p. 458.

Var. **extenuatum** H. f. & W., Fl. N.Z., ii, 84.

> Syn. *B. varium* H. f. & W., Fl. N.Z., ii, 85; Handb. N.Z. Fl., p. 444. *B. linearifolium* R. Br. ter., *op. cit.*, p. 453. *B. Kirkii* R. Br. ter., *op. cit.*, p. 454 (nec *B. Kirkii* Broth.). *B. macrocarpum* R. Br. ter., *op. cit.*, p. 455.

This is one of the most frequent species, and perhaps the most variable, not only in the vegetative but also in the fruiting characters. When once known, however, it is usually readily recognized. The leaves are ovate or oblong-lanceolate, acute or somewhat acuminate, with erect and quite unbordered margin, the nerve as a rule percurrent or only very slightly excurrent, but sometimes excurrent in a stout, cuspidate point. It very frequently happens that the leaves of the innovations are scarcely at all pointed, almost obtuse, very concave, with nerve ceasing below the apex, and they then contrast strongly with the leaves of the fertile stem. This is the form that gave rise to the names *B. varium*, *B. varians*, and *B. heterofolium*. The capsule is rather large, elongate, with a neck of equal length, and when normal is distinguished from all but *B. mucronatum* in being curved; the curving being partly in the neck, and often to a slight extent in the sporangium. The mouth is also rather narrow and the lid small. These characters, however, are not always present, especially in the smaller forms. The peristome also presents points of importance, but, unfortunately, equally variable. The inner peristome may be adherent to the outer or free; the cilia may be present or absent, but are nearly always, I believe, more or less imperfect, rarely appendiculate: the processes may be widely perforated, but are usually narrowly slit, and may even be entire; and the spores are rather large, frequently 20–25μ.

The var. *extenuatum* is taller, with longer seta, but is united to the type by intermediate forms.

It is, I think, very doubtful whether the species is rightly placed under Alpiniformia, but I do not know where better to put it.

I have little hesitation in referring *B. varium* here, but the available material is very scanty and sterile.

B. Levieri (type in herb. Mus. Berolin) is only a slender form of *B. curvicollum*. I have not been able to examine specimens of *B. varians* C. M., but the description is quite clearly that of *B. curvicollum*. Not only does the description agree at all points, but the characters emphasized by C. Mueller are exactly those by which *B. curvicollum* is distinguished. Further, C. Mueller adds, "An *B. varium* H. f. & W.," which confirms the identity with our species.

13. **Bryum laevigatulum** Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 176 (1898).

This was based on specimens collected at Waingaro, Auckland, by D. Petrie, and Mr. Petrie has sent me his original gathering. It appears to me a rather unsatisfactory species. It is certainly not nearly related to *B. laevigatum*, but to *B. curvicollum*; in fact, I can find no characters to separate it from that except the smaller spores (15–17μ), rather wide-mouthed capsule, and short seta (1·5 cm.). I feel some doubt as to whether the spores are properly matured; and I suspect that it may ultimately have to be united with *B. curvicollum*. Like that, it has the cilia rudimentary.

14. **Bryum crassum** H. f. & W., Fl. N.Z., ii, 86 (1855); Handb. N.Z. Fl., p. 442.

A very distinct species, of the true Alpiniformia habit, with densely imbricate, somewhat comose leaves of firm texture and scarcely altered when dry, the stout nerve and small incrassate cells contributing to this condition. The leaves are widely acute, the nerve percurrent or excurrent in a very short mucro; the margin recurved, not or scarcely bordered. The capsule is clavate, pendulous, with a short neck passing rather abruptly into the seta.

I have seen no New Zealand specimens but the original collected by Colenso. It is also recorded from Tasmania.

15. **Bryum appressifolium** Broth. in Oefv. af Finska Vet.-Soc. Foerh., xl, 175 (1898).

Syn. *B. Buchanani* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 450 (1899).

This is a very distinct species, allied to *B. crassum*, but with well-marked characters. The leaves are equally arranged along the much taller stems, not comose; much more narrowly and finely acuminate, with the nerve longly excurrent. The capsule, instead of being somewhat narrowly clavate, is very turgidly oval (wide-mouthed when dry), with a short, distinct, rapidly tapering neck, and is of a deep purple-brown; the lid hemispherical, apiculate, deep purple and shining. The peristome is large and solid, the teeth deep orange, broad, strongly bordered internally very closely trabeculate, externally densely transversely striolate (so strongly that the lamellae are hard to see); inner membrane high, deep orange. The teeth sometimes appear to be obtuse, but this is because they are abruptly incurved or hamate at the tip, where they are shortly and finely cuspidate. Spores minute. Cilia appendiculate.

B. Buchanani R. Br. ter. is the same thing, a rather robust form, often with long innovations. It is altogether a fine plant, and would appear to be a very rare and endemic species.

8. Trichophora.

16. **Bryum obconicum** Hornsch. *e* Bruch & Schimp., Bry. eur., iv, tab. 367 (1839); Fl. N.Z., ii, 85; Handb. N.Z. Fl., p. 440.

Syn. *B. creberrimum* Tayl. in Lond. Journ. Bot., v. 54 (1846); *p.p.*
B. contortum Stirt. in Proc. N.H. Soc. Glasgow, ii, 187 (1876).

The species of this group, of which *B. capillare* L. may be considered the type, are marked by a softer texture of the leaves than is usual in the genus, so that the leaves are much contracted when dry, and often spirally contorted round the stem. They are also much less acuminate than in most of the preceding species, being more or less obovate, wide at the top and very shortly cuspidate or even obtuse, and generally have the rather thin nerve excurrent in a long, flexuose arista. They are usually narrowly but distinctly bordered, with a few small but distinct teeth near apex; the cells rather lax, thin-walled and pellucid.

B. obconicum differs from *B. capillare* and *B. torquescens* in having the leaves firmer in texture, not or little spirally contorted when dry, with a usually stronger, often brownish border. It seems to pass, however, into *B. capillare* by a series of gradations, and some forms are difficult to separate. *B. contortum* Stirt. is one of these, and might almost equally be referred to *B. capillare*, a species which is recorded from Tasmania; but the leaves seem perhaps nearer to *B. obconicum*. It agrees exactly with specimens in Wilson's herbarium referred originally to *B. creberrimum* Tayl., and afterwards to *B. obconicum*. Some of the plants of *B. creberrimum* in Wilson's herbarium are *B. affine*, while others are *B. obconicum*; the latter, as indeed most or all the New Zealand specimens I have seen, belong to a smaller form than is usual in Europe, with laxer, more twisted leaves, and in fact constituting a transition from *B. capillare* to *B. obconicum*. I have seen much better marked plants of *B. obconicum* from Tasmania, however.

It is perhaps not a common species in New Zealand, but I have seen it from several localities.

17. **Bryum torquescens** Br. & Schimp., Bry. eur., iv. tab. 358 (1839); Handb. N.Z. Fl., p. 441.

Readily known by the leaves, which are strongly spirally contorted when dry, from all but certain forms of the last species, and from that by the synoicous inflorescence, and the deep reddish-brown capsule, not unlike that of *B. chrysoneuron*, but larger, longer, narrower, with still more tapering, somewhat curved neck, and larger lid.

B. capillare and *B. obconicum* differ in the dioicous inflorescence and usually paler, brown capsule.

B. torquescens is not uncommon. Like the preceding species, it is a plant of dry habitats.

9. Rosulata.

18. **Bryum Billardieri** Schwaegr., Suppl., i. pt. 2, p. 115 (1816); Fl. N.Z., ii, 86; Handb. N.Z. Fl., p. 439.

Syn. *B. rufescens* H. f. & W., Fl. Tasm., ii 192 (1860); Handb. N.Z. Fl., p. 439. *B. Searlii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 459 (1899)

A good deal of confusion has been brought into this group by the statement of the author and of C. Mueller (Syn., i, 253, 254), looked upon as authoritative and copied by several subsequent authors, that *B. Billardieri* has the leaves unbordered. This, however, is not the case. By the kindness of the curator of the herb. Boissier I have been able to examine Schwaegrichen's type, collected in "Novo Belgio." This shows the leaves quite distinctly bordered with two to three rows of narrow-linear, incrassate, brownish cells. The leaves are not markedly comose and not rosulate; they are suberect and very little spreading when moist, when dry contracted and somewhat twisted, but not markedly altered in position. The margin is strongly recurved to about three-fourths of the length of the leaf. The leaves are not decurrent, oblong-ovate or very slightly obovate (a little the broadest above the middle), not acuminate, broadly pointed and sharply acute. They are of two kinds: on the sterile branches with thinner nerve, thinner-walled wider cells (about 24μ wide, and 4–6 × 1): on the fertile branches with stouter nerve and smaller cells (10–12μ wide and 4–5 × 1), with firm, rather incrassate walls. The nerve is excurrent in a short, often recurved, cuspidate point.

The single capsule was overmature and old, pendulous, and rather strongly incurved.

The difference between it and *B. truncorum* is therefore not to be expressed by describing *B. Billardieri* as unbordered. The difference from what may be considered the typical form of *B. truncorum* is very marked: but there are less well marked forms of both, and in these cases it may not be at all easy to separate them, and the plant described by H. f. & W. as *B. rufescens* is so intermediate between the two that it is not at all easy to say to which, if either, it should be united. There is, in fact, an almost unbroken gradation from the weaker forms of *B. Billardieri*, with faint border and equally foliate branches, to the stoutest forms of *B. truncorum*, with densely comose leaves and strong border. The attempt has been made to evade the difficulty by describing the various forms as species (*B. rufescens*, *B. microrhodon* C. M., &c.), but it is doubtful whether anything is gained by this treatment. The characters of the three closely allied species, as here treated, may perhaps best be given thus :

Leaves unbordered, densely comose, appressed when dry	*B. campylothecium.*
Leaves with a narrow brownish border, oblong-obovate, suberect, not markedly comose	*B. Billardieri.*
Leaves with a wide often whitish border, usually spathulate, spreading when moist, usually markedly comose	*B. truncorum.*

B. rufescens must, I think, on the whole, be referred here. The specimens in Wilson's herbarium, " Tasmania, Oldfield, 263 ; springs, Mt. Wellington, are stout, with the leaves interruptedly comose, widely obovate, very concave, with stout reddish nerve and strong border. It is somewhat intermediate, as mentioned above, between *B. Billardieri* and *B. truncorum*, and I have seen some forms which are very difficult to place.

The specimens labelled " *B. erubescens*, V. D. Ld., Gunn, 1691," are very little different from *B. Billardieri*.

Mitten, I think, did not know the true *B. rufescens*, and the remarks in the Handbook under that plant are rather misleading.

It is probably common, but the records of this and the two allied species have been mixed up a good deal.

19. **Bryum truncorum** Brid., Sp. Musc., iii, 50 (1817) : Fl. N.Z., ii, 87 ; Handb. N.Z. Fl., p. 439.

Syn. *B. leptothecium* Tayl. in Phytol., vol. 1, p. 1094 (1844). *B. gracilithecium* R. Br. ter. in trans. N.Z. Inst., vol. 31, p. 453 (1899). *B. gracilicarpum* R. Br. ter., *op. cit.*, p. 462.

A highly variable plant, but readily known in all but its extreme forms by the densely comose leaves, widely spreading and rosulate when moist, large, obovate-spathulate, shortly pointed, with the nerve excurrent in a short reflexed point ; the rather small cells, and the strong border of narrow-linear, pale, incrassate cells, which being strongly recurved is often conspicuous as a whitish limb under the lens, especially when dry ; the usually long seta, and elongate, narrowly cylindric, often curved, pale capsule. It varies, however, very considerably in nearly all of these points. The leaves may be quite erect when moist, the border may be weak, the cells vary considerably even on the same plant, the comose arrangement of the leaves may be highly conspicuous or very little marked, and so forth ; so that the plant may at one time be mistaken for a *Rhodobryum*, and at another be scarcely separable from *B. Billardieri*.

I believe that Hook. f. & Wils. were quite correct in giving Bridel's name to this. Taylor in describing his *B. leptothecium* does not compare it with the African plant, only with *B. Billardieri* and *B. campylothecium*, to which it is less closely related. Comparison with the Mascarene plant does not show any differences. The capsule may be normally rather narrower in the Australasian plant, but wider capsules with straight neck occur there quite similar to those of *B. truncorum* : I have, moreover, been able to see only a small range of fruiting specimens of the African form, and it is quite probable that the capsule there varies within the same limits as the Australian one.

I have examined specimens from his herbarium of the two species of Brown's placed in the synonymy.

20. **Bryum campylothecium** Tayl. in Lond. Journ. Bot., v, 52 (1846); Fl. N.Z., ii, 86; Handb. N.Z. Fl., p. 439.

This species has been confused with the last, and with *B. Billardieri*; indeed, the original description is, according to Wilson, compounded of two plants. The true species is probably rare, and is quite distinct. It is much smaller; the leaves are densely comose in small compact heads, suberect when moist, when dry closely appressed and little altered in form, not contracted or twisted, and they are quite without the border of narrow cells so marked in the two preceding species.

21. **Bryum laevigatum** H. f. & W. in Lond. Journ. Bot., iii, 546 (1844); Handb. N.Z. Fl., p. 440.

Syn. *B. crassinerve* H. f. & W., Fl. N.Z., ii, 83. *B. Traillii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 460 (1899).

In this and the three succeeding species the leaves are not comose as in the preceding ones of the group, but fairly equally arranged along the stem. They are very concave, shortly and widely pointed, and more or less cucullate, with the nerve scarcely at all excurrent, usually percurrent, or even ceasing just below the apex. The seta is usually long, and the capsule rather large, sometimes very elongate. The three following plants are usually very different in habit from the present, but they present few or no constant structural differences, and I am inclined to suspect that they are really links in a continuous chain, of which *B. incurvifolium* represents the slender form and *B. eximium* the very robust, *B. Huttonii* forming a link between that and *B. laevigatum*. For the present, however, I keep them distinct. The differences may be tabulated as follows:—

B. incurvifolium.—Slender, elongate, with small, scarcely bordered leaves; margin nearly plane; cells small, incrassate.

B. laevigatum.—Moderately robust; leaves about 2 mm. long, bordered, with margins strongly recurved below; seta about 3 cm.; capsule 3–4 mm., bright reddish-brown.

B. Huttonii. Very tall; leaves slightly longer and larger, margin less recurved; cells slightly larger; seta 4–5 cm.; capsule 4–5 mm., paler.

B. eximium.—Very robust, with lax, widely spreading, very large leaves, 4–6 mm. long; sterile.

22. **Bryum incurvifolium** C. M. in Bot. Zeit., 1851, p. 549.

See note above, under *B. laevigatum*. It has not been found in fruit, and may conceivably be the male plant of that species. I know of only one record of it since the original publication—viz., Mount Cook district, where it was collected by James Murray in 1907; but I find two gatherings in Brown's herbarium which must be referred here, one without locality beyond "South I.," the other from the west coast in the same Island.

23. **Bryum Huttonii** R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 460 (1899).

A fine species, though, as remarked above, not easy to define structurally. The fruiting characters mentioned above may have some weight. An unnamed plant in Brown's herbarium, which I refer here, shows some approach towards *B. eximium.* It has been collected from only one or two localities in the South Island.

24. **Bryum eximium** Mitt. in Hook. f., Handb. N.Z. Fl., p. 440 (1867).
Syn. *B. megamorphum* C. M. in Hedwig., vol. 37, p. 99 (1898).

This remarkably fine plant will, I fear, ultimately have to be looked upon as a striking marsh form of *B. laevigatum*. As remarked above, the leaves are distant throughout, widely spreading, horizontal or even slightly reflexed, and very long; the stems may be 6 in. tall.

Magnificent specimens occur in Brown's herbarium, with stems 6 in. in height, and in good fruit. The setae are sometimes aggregate, 5–7 cm. long, the capsules 4–6 mm. or even 7 mm. long, but not apparently differing otherwise from those of *B. Huttonii*. It has been found, I believe, only in marshes near Dunedin, and Styx marsh, near Christchurch, in addition to the localities mentioned in the Handbook.

INCERTAE SEDIS.

Bryum flaccidum Brid. ? Fl. N.Z., ii, 85; Handb. N.Z. Fl., p. 444.—I have examined this in Hooker's herbarium, as well as Wilson's specimen, and am not able to form a definite opinion on it: the material is very small. It is scarcely *B. flaccidum*, if that is, as C. Mueller (Syn., i, 281) has it, a variety of *B. capillare*; and it is still further from *B. caespiticium*. I think it must remain an unsolved problem at present. It is probably a weak form of one of the described species.

EXCLUDED SPECIES.

B. intermedium Brid.—The specimen of this in Wilson's herbarium is certainly *B. torquescens* B. & S. *B. intermedium* does, however, occur in Tasmania, so there is no reason why it should not be found in New Zealand.

B. murale ? in herb. Wils. (Buchanan, 102B) is a small form of *B. chrysoneuron* C. M.

B. atropurpureum W. & M.—I have examined the specimens in Wilson's and Hooker's herbaria referred to this species. I find them all referable to *B. dichotomum* Hedw. except one (Hook., No. 355, N.Z.), which is a starved form of *B. chrysoneuron*.

B. urceolatum Schimp. MS. in herb., Tauranga, Ch. Knight, No. 108, is *B. dichotomum* Hedw.

B. suboeneum Hampe & C. M., Tauranga, Hutton, 107; Knight, 1867, No. 143; both in herb. Schimp., are not *B. suboeneum* (which is probably *B. pachytheca*), but *B. dichotomum*.

B. pyrothecium Hpe. & C. M.—All the New Zealand specimens in herb. Kew are *B. torquescens*, from which *B. pyrothecium* itself does not probably differ.

B. purpureum Schimp., MS. in herb., Wairoa, N.Z.; Knight, 1867, No. 114; is a purple and very pretty form of *B. dichotomum*.

B. australe Hampe ? New Zealand, F. M. Reader, 54, det. Mitten in herb. Kew, is *B. chrysoneuron* C. M.

B. pyriforme Hedw. = *Leptobryum piriforme.*
B. Wahlenbergii Schwaegr. = *Pohlia albicans.*
B. crudum Schreb. = *Pohlia cruda.*
B. nutans Schreb. = *Pohlia nutans.*
B. tenuifolium H. f. & W. = *Pohlia tenuifolia.*
B. bealeyense R. Br. ter. = *Pohlia nutans.*
B. torlessense R. Br. ter. = *Pohlia nutans.*
B. Barrii R. Br. ter. = *Pohlia tenuifolia.*
B. Harriottii R. Br. ter. = *Anomobryum Harriottii.*
B. Binnsii R. Br. ter. = *Pohlia tasmanica.*
B. Cockaynei R. Br. ter. = *Leptobryum piriforme.*
B. Evei R. Br. ter. = *Leptotheca Gaudichaudii.*
B. Whittonii R. Br. ter. = *Pohlia tenuifolia.*

B. calcareum R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 450, is a composite species; in part starved *Pohlia tenuifolia*, a very reduced, starved *Bryum*—possibly *B. caespiticium.*

B. Thomsonii R. Br. ter., *op. cit.*, p. 447, is also a composite species; one specimen in Brown's herbarium contains two species of *Bryum* with setae only, quite indeterminable; the specimen in the Christchurch collection is *B. affine.*

LEPTOSTOMACEAE.

Leptostomum R. Br. in Trans. Linn. Soc., x. 320 (1811).

A striking and interesting genus, consisting of about ten species, with a very limited distribution. After careful study of the descriptions and specimens I am quite unable to detect any difference between *L. inclinans* and *L. gracile.* Authorities differ widely in their attempts to discriminate between them. The Handbook would give *L. gracile* a straight hair-point (which I have never seen in any specimen, nor is it so figured in the Musci Exotici by Hooker), and is careful to suggest no other differences. Hooker is the Musci Exotici gives some quantitative differences in size of plant, length of seta, &c., but I do not find these correlated together in the New Zealand plants. A long seta is, *e.g.*, often associated with a robust habit, and *vice versa.* The length of seta and size of capsule are highly variable. I have therefore united the two, so that there are but two New Zealand species—*L. macrocarpum* and *L. inclinans.*

The two species can be at once separated as follows:—

Hair-point of upper leaves branched	1. *macrocarpum.*
Hair-point simple	2. *inclinans.*

1. **Leptostomum macrocarpum** (Hedw.) R. Br. in Trans. Linn. Soc., x, 322 (1811); Fl. N.Z., ii, 82; Handb. N.Z. Fl., p. 436.

Syn. *Bryum macrocarpum* Hedw., M. frond., iii, 28 (1792). *Helmsia collina* Bosw. in Journ. Bot., xxxii, 82 (1894). *Leptostomum Schauinslandi* C. M. in Abhandl. nat. Ver. Bremen, 1900, p. 508.

Brotherus (Musci, p. 603) gives it as his opinion that *L. Schauinslandi* C. M. is scarcely separable from *L. macrocarpum.* There is certainly nothing in the description that suggests a difference, and the so-named specimen from Mount Egmont distributed by Fleischer (Musc. frond. Arch. Ind. et Polynes., No. 466) is certainly only *L. macrocarpum.*

2. **Leptostomum inclinans** R. Br., *op. cit.*, p. 320 (1811); Fl. N.Z., ii, 82; Handb. N.Z. Fl., p. 435.

Syn. *Gymnostomum inclinans* Hook., Musc. Exot., t. 168 (1820). *Leptostomum flexipile* C. M. in Bot. Zeit., 1851, p. 547. *L. gracile* R. Br., *op. cit.*, p. 321 (1811); Fl. N.Z., *loc. cit.*; Handb. N.Z. Fl., p. 435. *Gymnostomum gracile* Hook., Musc. Exot., t. 22 (1820).

A very variable species in size and habit, as mentioned above.

Both species seem widely distributed in New Zealand.

MNIACEAE.

MNIUM Linn. emend Schimp. in Bry. eur. Consp. ad Vol., iv (1851).

Mnium rostratum Schwaegr., Suppl. I, pt. ii, p. 136; Fl. N.Z., ii, 87; Handb. N.Z. Fl., p. 444.

Syn. *M. rhynchophorum* Hook. in Lond. Journ. Bot., ii, 11 (1840); Handb. N.Z. Fl., p. 444. *M. novae-zealandiae* Col. in Trans. N.Z. Inst., vol. 18, p. 225 (1885). *M. xanthocarpum* Col., *op. cit.*, vol. 20, p. 239 (1887).

I am fully in agreement with Fleischer (Musci . . . von Buitenz. ii, 581) in reducing *M. rhynchophorum* Hook. to *M. rostratum*, which is an almost cosmopolitan and rather variable plant. He includes *M. pseudo-rhynchophorum* Broth. in sched. (herb. T. W. N. Beckett). This was separated from *M. rostratum* principally on the ground of the dioicous inflorescence, but it is doubtful whether this is a constant character, and it is one which is occasionally found in Indian specimens of *M. rostratum* without being correlated with other characters. I do not think it is more than an abnormality.

There is nothing in the descriptions of Colenso's two species to suggest any difference from *M. rostratum*. The aggregate setae by which he characterizes *M. xanthocarpum* are quite usual in *M. rostratum* (see the plate in Bry. europaea).

RHIZOGONIACEAE.

HYMENODON H. f. & W. in Lond. Journ. Bot., iii, p. 548 (1844).

A small genus of five or six species confined to the Southern Hemisphere of distinct habit and foliation, and especially distinguished from other genera of the family by having an endostome only, of 16 entire processes without cilia; the outer peristome being wanting. It is represented in New Zealand by a single species. The fruit-stalk is lateral, from near the base of the stem, as in many species of *Rhizogonium*.

Hymenodon piliferus H. f. & W. in Lond. Journ. Bot., iii, 548 (1844).

Syn. *Hymenodon helvolus* C. M. in Hedwig., vol. 36, p. 332 (1897).

A delicate little plant of a glaucous green colour, with leaves subdistichously arranged, and little altered when dry, oblong-elliptic, obtuse, with a delicate hair-point. The capsule is erect and practically symmetric, ovoid, and I think on this account *Hypnum Mougeotianum* A. Rich. cannot belong here, as the Handbook suggests, following the Fl. N.Z.

RHIZOGONIUM Brid., Bryol. univ., ii, 664 (1827).

The position of this genus has given much perplexity to systematists; on account of the lateral or basal inflorescence it has been placed by many authors in the Pleurocarpi, but its affinity is rather with the Mniaceae, and the difficulty is probably best solved by placing it, as Fleischer has done, with its closely allied genera, in a family of its own.

KEY TO THE SPECIES.

Leaves very narrow, more or less subulate	2
Leaves wider, oblong-ovate or ovate-lanceolate	3
Leaves much crisped when dry; fruit lateral	5. *mnioides.*
Leaves slightly crisped when dry; fruit basal	6. *spiniforme.*
Leaves doubly serrate at margin	4. *bifarium.*
Leaves simply serrate	4
Leaves bordered with narrow cells	1. *pennatum.*
Leaves not bordered	5
Nerve excurrent, subequal throughout leaf, leaves oblong-lanceolate	2. *novae-hollandiae.*
Nerve ceasing below apex, very wide below, leaves widely ovate-oblong	3. *distichum.*

1. Rhizogonium pennatum H. f. & W., Fl. N.Z., ii, 116 (1855); Handb. N.Z. Fl., p. 484.

Syn. *R. sinuatum* C. M. in Hedwig., vol. 36, p. 333 (1897).

A delicate species with distichous, narrowly oblong-lanceolate leaves, with a stout cartilaginous border, entire or slightly toothed above (the description in the Handbook, "leaves quite entire," is incorrect), and with the nerve excurrent in a stout arista. The capsule is inclined when young, horizontal when old, with the seta very abruptly bent at the capsule-base.

Var. aristatum (Hampe) Dixon comb. nov.

Syn. *Rhizogonium aristatum* Hampe in Linn., xl, 314 (1876).

Leaves a little wider and less tapering usually, nerve and border rather narrower, border usually with two or three sharp teeth on each side near apex; cells a little more distinct.

The type of *R. pennatum* has the leaves not perfectly entire, but occasionally with one or two distinct teeth. Hampe's plant is certainly not more than a variety, and I suspect that further investigation will show that no clear line can be drawn between the two.

R. pennatum appears to be rare; I have seen it only from the South Island; but it occurs in Tasmania and Australia.

2. Rhizogonium novae-hollandiae Brid., Bryol. univ., ii, 664 (1827); Fl. N.Z., ii, 116; Handb. N.Z. Fl., p. 484.

Also a delicate plant, with rather glossy, narrow, oblong-lanceolate, pellucid leaves, having a mucronate or cuspidate point mostly formed by the excurrent or subexcurrent nerve. The cells are small (13–16μ. wide), with firm, slightly incrassate walls, the marginal in two or three rows often slightly differentiated, especially towards base, and sometimes opaque, so that the leaves may be indistinctly and narrowly bordered. The capsule is inclined or horizontal, narrower and longer than in the preceding species.

It is a fairly frequent plant.

3. **Rhizogonium distichum** (Sw.) Brid., Bryol. univ., ii, 665 (1827) ; Fl. N.Z., ii, 115 ; Handb. N.Z. Fl., p. 484.

> Syn. *Hypnum distichum* Sw. in Schrad. Journ., iv, 179. *Rhizogonium Muelleri* Hampe in Linn., xxviii, 211 (1855–56).

Readily known by the wide, not or scarcely glossy leaves, with no trace of border, the cells rather large (14–18μ) and thin-walled, usually opaque with chlorophyll, the nerve ceasing below the apex, smooth at back, very wide and rather ill-defined, especially below. The fruit is very similar to that of the preceding species. Like that, it is widely distributed in New Zealand.

4. **Rhizogonium bifarium** (Hook.) Schimp. in Bot. Zeit., 1844, p. 125 ; Fl. N.Z., ii, 116 ; Handb. N.Z. Fl., p. 485.

This species belongs to a different section of the genus from the preceding ; in these the inflorescence is basal, the stems simple, radiculose only at base ; in the present the fruit is lateral, the stems branched above, and radiculose some way up. The leaf-margin here is somewhat thickened and the serratures are often double ; the nerve also is spinose at back, and the capsule is strongly curved and asymmetrical, expecially when dry and empty.

It is a frequent species.

5. **Rhizogonium mnioides** (Hook.) Schimp., *op. et loc. cit* : Fl. N.Z., ii, 116 ; Handb. N.Z. Fl., p. 485.

> Syn. *Hypnum mnioides* Hook., Musc. Exot., t. 77 (1818). *Mnium Hookeri* C. M., Syn., ii, 555 (1851). *Rhizogonium Hookeri* Jaeg., Adumbr., i, 685. *R. spiniforme* var. β H. f. & W., Fl. Antarct., i, 137 ; Handb. N.Z. Fl., p. 485. *Hypnum subbasilare* Schwaegr. Suppl., iii, pt. ii, t. 256 (*nec* Hook.).

This and the following species differ from all the preceding in the much more robust habit, lanceolate-subulate not distichous leaves, sharply doubly spinose along most of the margin. The present species differs from *R. spiniforme* in having much shorter and less finely subulate leaves, which are more strongly crisped when dry than is usual in that species ; smaller cells, which are opaque, not pellucid as in that ; the inflorescence also is lateral and dioicous, while in *R. spiniforme* it is basal, and autoicous or synoicous. The capsule in both resembles that of *R. bifarium.*

Rhizogonium Hookeri is placed in the Handbook N.Z. Fl. as a variety of *R. spiniforme* –" Stems more slender, leaves shorter " ; but the original plant of Hooker is certainly *R. mnioides*, as are other specimens I have seen so named. Several of the characters attributed by C. Mueller to his *Mnium Hookeri* are quite inapplicable to Hooker's specimens. Besides which, all the fruiting specimens named *R. Hookeri* at Kew have the setae lateral, not basal.

Leptotheca Gaudichaudii is not unlike *R. mnioides*, but is more slender, with the leaves falcately incurved when dry, not crisped.

6. **Rhizogonium spiniforme** (L.) Bruch in Flora, xxix, 134 (1846); Fl. N.Z., ii, 116; Handb. N.Z. Fl., p. 485.

Syn. *Hypnum spiniforme* Linn., Sp. Pl., p. 1587.

The most widely spread species, occurring in practically all the tropical and subtropical regions of the world. Curiously, it does not seem to be so common in New Zealand as most of the other species. Only two specimens in the Kew collection are from New Zealand: and in the numerous collections of mosses I have received from there I have seen no specimens of this species.

EXCLUDED SPECIES.

R. subbasilare (Schwaegr.) = *Goniobryum pellucidum.*

GONIOBRYUM Lindb. in Oefv. af K. Vet.-Akad. Foerh., xxi, 606 (1864).

Separated from *Rhizogonium* principally on account of the areolation, of lax cells, which are not small and isodiametrical as in that genus but elongated, lax, and prosenchymatous.

There are three species, *G. pellucidum* (Mitt.), *G. reticulatum* H. f. & W., and *G. subbasilare* (Hook.) Lindb.; and the New Zealand plant has figured at least two of these names, but the first is the only species that actually, as far as is known, occurs in New Zealand.

Goniobryum pellucidum (Mitt.) Broth. in Engl. & Prantl., Pflanzenfam., Musci, i, 621 (1904).

Syn. *Photinophyllum pellucidum* Mitt. in Journ. Linn. Soc., Bot., x, p. 175 (1868). *Rhizogonium pellucidum* Jaeg., Adumbr., i, 683. *R. subbasilare* H. f., Handb. N.Z. Fl., p. 485, nec *R. subbasilare* Schimp., nec *Hypnum subbasilare* Schwaegr.

Readily known by the basal fruit, and the narrowly lanceolate leaves, doubly spinose at margin, with lax, pellucid, rhomboid-hexagonal cells. It is, I think, a not very common species.

The synonymy is at first sight rather puzzling, but is easily explained. Schwaegrichen described a *Hypnum subbasilare*, which is *Rhizogonium mnioides* (Hook.) Schimp. Hooker described a *Hypnum subbasilare*, which is *Goniobryum subbasilare* Lindb. The Handbook refers the present plant by error to this last species, as *Rhizogonium subbasilare* Schimp.; but that species is principally or entirely a Fuegian plant, and does not occur in New Zealand. Both it and *G. reticulatum* (H. f. & W.) Lindb. are distinguished from our species by the single serratures of the leaves.

CRYPTOPODIUM Brid., Bryol. univ., ii, 30 (1827).

This remarkable and beautiful monotypic genus is rather a taxonomic puzzle, and I feel far from certain that it is in its right place in the Rhizogoniaceae, and am inclined to think that it should be placed in a family by itself.

Cryptopodium bartramioides (Hook.) Brid., Bryol. univ., ii, 31 (1827); Fl. N.Z., ii, 88; Handb. N.Z. Fl., p. 446.

Syn. *Bryum bartramioides* Hook., Musc. exot., t. 18.

A fine plant, resembling in some degree *Cyrtopus setosus*, but with much longer leaves, which are gracefully falcate when dry, and with terminal, often aggregate capsules, short and widely elliptic, not furrowed, on a very short seta, so that the fruit is quite concealed in the upper leaves and may easily pass unnoticed. The leaves are much like those of *Rhizogonium spinoforme.*

The distribution of the species is usually given as New Zealand and the Sandwich Isles. It is recorded from the latter by Gaudichaud in Freycinet's work on the voyage of the "Uranie" and "Physicienne," as collected by him "in Insulis Sandwicensibus." Wilson, in his herbarium, however, has mounted leaves of *C. bartramioides* from New Zealand side by side with leaves of Gaudichaud's plant ex herb. Arnott, remarking of the latter, "belong rather to *Hypnum spiniforme*; leaves bordered, doubly sharply spinous" The leaves of *R. spiniforme* are remarkably like those of the present species, and I should think Wilson is undoubtedly correct, and that *Cryptopodium* (as limited by Brotherus to the present species) is a truly endemic genus in New Zealand.

LEPTOTHECA Schwaegr., Suppl., ii, pt. 2, p. 135.

Leptotheca Gaudichaudii Schwaegr., *op. et. loc. cit.* (1824).

Syn. *Aulacomnium Gaudichaudii* Mitt. in Kew Journ. Bot., viii (1856), p. 262; Handb. N.Z. Fl., p. 436. *Bryum Erei* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 456 (1899).

Leptotheca differs from *Aulacomnium* in the smooth cells, and the excurrent nerve, which in the perichaetial leaves forms a long arista. The capsule is cylindric, erect, striate-plicate when dry. Densely tufted brown brood-filaments often occur in the axils of the upper leaves.

It somewhat resembles *Rhizogonium mnioides* in habit, but the shorter subentire leaves, and especially the capsule, will at once distinguish it.

AULACOMNIUM Schwaegr., Suppl., ii, pt. 1, t. 215 (1827).

Aulacomnium palustre (L.) Schwaegr., *op. et. loc. cit.*; Bry. eur., iv, t. 405.

This widely distributed paludal moss was recorded by me for New Zealand in Journ. Linn. Soc., Bot., xl, 450. I have not seen any further records of it. The flexuose oblong-lanceolate leaves, toothed at apex, shortly and widely pointed or obtuse, with isodiametrical, highly papillose cells, and thin nerve ceasing below apex, is, when once known, easily recognizable. The capsule is very similar to that of *Leptotheca Gaudichaudii*, but is inclined and curved. It is not often produced.

The Mount Cook plant was a slender form with small, laxly set leaves.

MEESEACEAE.

MEESEA Hedw., Fund., ii, p. 97 (1782).

A genus of paludal mosses with highly asymmetric, gibbous, long-necked capsule (Funarioid in form): peristome double, outer teeth short, wide, obtuse: processes of inner considerably longer, linear, more or less moniliform.

Meesea Muelleri C. M. & Hampe in Linn., xxviii, 208 (1856).

> Syn. *M. macrantha* Mitt. in Kew Journ. Bot., viii, 260 (1856) Handb. N.Z. Fl., p. 444. *M. Kirkii* R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 463 (1899). *M. Buchanani* R. Br. ter., *op. cit.*, p. 464. *M. aquatica* R. Br. ter., *op. cit.*, p. 465. *M. aquatilis* R. Br. ter., *op. et loc. cit.*

A usually tall, richly fruiting, paludal moss, with oblong-lingulate, widely obtuse, entire leaves, somewhat lax, pellucid, subquadrate, smooth upper cells, and nerve ceasing much below apex.

R. Brown's species must all be referred here, except *M. craigieburnensis* (*vide infra*). The author admits similarity in the leaves, but relies on the capsules for distinctive characters. Neither the descriptions, the figures, nor Brown's own specimens, however, show any marked differences. The only obvious distinctions in the sporophyte are the length of seta: but this varies in proportion to the degree of robustness of the plants, which again is probably dependent on the degree of moisture of the habitat. A very unusual degree of variation in the length of seta is, moreover, characteristic of the genus: thus the northern *M. trichodes* has a seta varying between 1 cm. and 8 cm. *B. Kirkii* R. Br. ter. is a short dense form. *M. Buchanani* is marked by the straight, parallel, equally foliate branches, giving the tufts a very regular, neat appearance. *M. aquatilis* and *M. aquatica* are very ordinary forms of *M. Muelleri.*

EXCLUDED SPECIES.

M. craigieburnensis R. Br. ter. in Trans. N.Z. Inst., vol. 31, p. 464 = *Funaria subcuspidata* Broth.

BARTRAMIACEAE.

All the New Zealand species of this family are placed under *Conostomum* and *Bartramia* in the Handbook of the New Zealand Flora. Bartramia has been much subdivided in recent years, and four of the genera as arranged by Brotherus are represented in New Zealand. These are generally easily recognizable when once known, but are not easy to define. I have not followed Brotherus in separating the genus *Plagiopus* Brid. (including *B. crassinervia* Mitt.), as the characters appear to me slight, and rather elusive. The remaining three genera correspond to the sections in the Handbook. The subspherical, deeply plicate capsule is characteristic of most of the genera and of all the New Zealand species, except in one or two cases.

The genera may be analysed as follows :—

1.	Peristome-teeth united above ; leaves very small	*Conostomum.*
	Peristome-teeth not united	2
2.	Leaves more or less plicate	*Breutelia.*
	Leaves not plicate	3
3.	Branches irregular or fasciculate, not whorled ; male flower gemmiform	*Bartramia.*
	Stems divided, with whorled subfloral innovations ; male flower often discoid ; mostly paludal plants	*Philonotis.*

Bartramia Hedw., Descr., ii, p. iii (1789).

Key to the Species.

1.	Leaf-base not distinctly differentiated ; upper cells isodiametrical, distinct	2
	Leaf-base distinct and sheathing ; upper cells elongate, obscure ..	3
2.	Tall ; seta scarcely longer than the capsule	1. *norvegica.*
	Short, densely tufted ; seta about 1 cm.	2. *crassinervia.*
3.	Capsule inclined ; peristome developed	3. *papillata.*
	Capsule erect and symmetrical before maturity ; peristome O ..	4. *robusta.*

1. **Bartramia norvegica** (Gunn) Lindb. in Oefv. af Finsk. Vet.-Akad. Foerh., xx, 389 (1863).

Syn. *B. Halleriana* Hedw., Descr., ii, pt. 3, t. 40 (1789) ; Fl. N.Z. ii, 88 ; Handb. N.Z. Fl., p. 446. *B. Mossmaniana* C. M. in Bot. Zeit., 1851, p. 551. *B. hallerianoides* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 140 (1899). *B. Beckettii* C. M., Gen. Musc. frond., p. 352 (*nomen*).

Quite distinct in the tall stems, long leaves, crisped when dry, not sheathing at the base, and the capsule on a very short, slightly curved seta, soon becoming lateral by innovation, and remaining for some time on the stem.

Cardot retains the southern plant (as *B. Mossmaniana*), distinguishing it from *B. norvegica* by the leaves more crisped when dry, and the synoicous or polygamous inflorescence. The leaves are certainly more crisped when dry than in the northern plant, but I have New Zealand plants with the leaves less crisped than usual, and which do not differ materially from some British plants. The inflorescence can hardly be insisted on, since in *B. magellanica* Aongstr., which is united by Cardot and others with *B. Mossmaniana*, the inflorescence is autoicous.

B. Beckettii C. N. ined., type ex Mus. Berol., is quite inseparable.

R. Brown distinguishes his *B. hallerianoides* by several characters from the European plant, but these characters will not stand, and as regards the latter are indeed incorrect.

2. **Bartramia crassinervia** Mitt. in Hook. f., Handb. N.Z. Fl., p. 447 (1867).

So far as I am aware this has not been collected since its first gathering by Haast. It is represented at Kew by a single tuft only, a short dense plant of a glaucous green, the leaves rather crisped when dry ; it is recognizable at once under the microscope by the well-defined nerve, and small, distinct, isodiametrical and quadrate upper cells. The leaf-base may be somewhat sheathing, but is not markedly so as in the species belonging to the section Vaginella. The margin is either plane or narrowly recurved.

Mitten describes the nerve as thick, broad, and occupying one-fourth of the width of the leaf. This is certainly not an overstatement. The seta is about 1 cm. long.

Brotherus places this with the European *B. gracilis* (*B. Oederi* Sw.) in the genus *Plagiopus* Brid.; but the characters scarcely seem to me to warrant generic rank.

3. **Bartramia papillata** H. f. & W., Fl. N.Z., ii, 89 (1855); Handb. N.Z. Fl., p. 447.

> Syn. *B. acerosa* C. M. & Hampe in Linn., xxviii, 208 (1856). *B. fragilis* Mitt. in Journ. Linn. Soc., Bot., iv, 81 (1859). *B. Gibsoni* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 139 (1899). *B. brevifolia* R. Br. ter., *op. et loc. cit.* *B. linearifolia* R. Br. ter., *op. cit.*, p. 141. *B. robustifolia* R. Br. ter., *op. et loc. cit.* *B. Bellii* C. M., Gen. Musc. Frond., p. 351.

The most frequent and most distinct species, albeit rather highly variable: the broad, dilated, whitish sheathing-base being very conspicuous, often without dissection. The lamina is very obscure and opaque; the leaves may be somewhat flexuose when dry, but are usually rigidly divaricate, as when moist; they are often highly fragile.

I have examined the type of *B. Beckettii* in C. Mueller's herbarium; it is only *B. papillata.*

I have referred the four species of R. Brown here with some amount of doubt, as no specimens exist in his herbarium. The descriptions do not, however, suggest any distinctive characters, except in one respect, that he describes the inflorescence of *B. Gibsonii* and *B. brevifolia* as monoecious. I am not, however, inclined to place too much stress on this. In the first place, the inflorescence in this group, I am convinced, requires more investigation I am doubtful if it is as constant as has been supposed; and, in the second place, Brown describes his "*B. patens* Brid., Mt. Fife, Kaikoura," as dioecious. Now, if there is any character which will certainly separate *B. patens* from *B. papillata* it is the synoicous inflorescence of the former; and it would appear that Brown was not too careful in his examination of the inflorescence in this genus. In no case does he describe the male flower.

B. patens Brid. is recorded from several localities in the Handbook. I have treated all the New Zealand plants as coming under *B. papillata*, excluding *B. patens* (confined to the subantarctic region). This is the conclusion arrived at by Brotherus in the Musci. It is, however, a difficult problem to solve. The differences between the two are very elusive. The Handbook separates them solely on differences of the leaf-blade and base, which are both ill defined and quite inconstant. Brotherus separates them as follows:—

> *B. papillata.*—Dioicous. Inner peristome wanting.
> *B. patens.*—Synoicous. Peristome double.

I have, however, New Zealand specimens with the peristome double—though the inner is slightly imperfect; and Brown describes his *B. brevifolia* with a well-developed inner peristome; but in neither case is it accompanied by a synoicous inflorescence (*B. brevifolia* is at least described as "monoecious").

B. patens is a widely distributed and highly variable moss in the subantarctic region; it is synoicous, and has a double peristome, the inner adherent to the outer and slightly imperfect. A number of minor species have been described which are probably only forms of *B. patens*. The New Zealand *B. papillata* varies on parallel lines. It would therefore appear that there are two forms the Australasian dioicous, the subantarctic synoicous—inseparable by any other characters, and highly variable in parallel directions. It seems clear that the inflorescence needs more extended study, and I should be quite prepared to find that this revealed a heteroicous condition which would lead to the plants being united as *B. patens*.

The Campbell Island record of *B. patens* is based on sterile specimens, and cannot therefore be safely referred there.

4. **Bartramia robusta** H. f. & W., Fl. Antarct., i. 153 (1845); Handb. N.Z. Fl., p. 447.

This is described as differing from *B. patens*—and therefore (inflorescence excluded) from *B. papillata*—in the more robust habit, with broader and more rigid leaves, the dilated base truly quadrate (*i.e.*, not oblong or obovate), the capsule perfectly erect, and the lid rostellate; and essentially in the dioicous inflorescence. There is some doubt whether peristome exists.

The form of the leaf-base varies so greatly in this section that it will not afford a basis for specific distinction; there is no form constant to *B. papillata*. The capsule in the type specimens of *B. robusta* is truly erect and symmetrical, and this may be a character of some importance; but the unripe capsule in all the allied species tends to be more erect than when mature, and the mature capsules in *B. robusta* are decidedly suboblique. If the capsule is strictly gymnostomous this would of course, be a strong character; the numerous old capsules show no trace of peristome, but capsules of *B. papillata* at the same stage often betray no trace of it, and its absence is no certain indication that the fruit is truly gymnostomous.

I have New Zealand plants (coll. R. Brown ter., without locality—probably his *B. robusta* from Mount Torlesse, but unnamed) which exactly agree with the Lord Auckland Islands specimens in size, leaf, and capsule, which, as in those, have lost all trace of peristome, if it were present. Young capsules are wanting, to show if erect or not. A very similar plant, however, gathered by Dr. Cockayne in the Craigieburn Mountains, has a double peristome.

On the whole I am inclined to think *B. robusta* only a stout form of *B. papillata*, but pending further investigation it seems better to let it stand, on the basis of its erect (young) fruit, and the possibly gymnostomous capsule.

It is recorded definitely only from the Lord Auckland Islands in the New Zealand region. The Mount Torlesse plant referred to above, and a plant from the Mount Cook district (coll. James Murray, No. 91), may also belong here.

EXCLUDED SPECIES.

B. patens Brid.—See note under *B. papillata.*

B. pomiformis Brid.—Included by Brotherus, Paris, &c., on the strength of the record in Trans. N.Z. Inst., vol. 29 (1896), p. 443, by Beckett. This was, however, an error, as pointed out by R. Brown (*op cit.*, vol. 32, p. 137). The species was *B. papillata*, as is evidenced by a specimen I have of the original plant on which the record was based: the determination as *B. pomiformis* was a slip.

B. Readeriana Col. in Trans. N.Z. Inst. vol. 17, p. 258 (1884) = *Breutelia pendula.*

Other species in the Handbook belong under either *Breutelia* or *Philonotis.*

CONOSTOMUM Sw. in Schrad. N. Journ. Bot., i, pt. 3, p. 26.

A small genus of moses, differing from *Bartramia* principally in the peristome teeth being united at their apices into a cone: the capsule is usually a little more elongate, with a curved beak to the lid; and the leaves are small, rigid, usually closely imbricated and regularly arranged in five series, so that the stems are more or less pentagonal. This character, however, is not found in all species.

R. Brown ter has described five new species, but four of these certainly and in all probability the fifth, belong to *C. pusillum*, of which Brown says that he has seen no specimens. He quite correctly judges that according to the description of that species it must differ from those which he describes as new, since, as he says, "This species will be easily determined by the margins of the leaves being recurved and the double serration on them." But this description, taken from the Handbook, and followed by other authors, is quite misleading, and indeed incorrect. The leaf-margin in *C. pusillum* is usually plane, or very slightly and narrowly recurved above, and, while varying in toothing from being almost entire to regularly denticulate for much of its length, it is never so far as I have seen it, doubly denticulate.

KEY TO THE SPECIES.

Nerve $\frac{1}{3}$–$\frac{1}{2}$ width of leaf, ill defined .. .. 1. *australe.*
Nerve $\frac{1}{5}$–$\frac{1}{4}$ width of leaf, well defined .. .. 2. *pusillum.*

1. Conostomum australe Sw. in Schrad., *op. et loc. cit.* (1806): Fl. N.Z., ii, 87; Handb. N.Z. Fl., p. 445.

Syn. *Philonotis australis* Mitt. in Journ. Linn. Soc., Bot., iv, 81 (1859) (nec *Philonotis australis* (Mitt.) Jaeg, Adumbr., i, 551).

A considerably larger plant than the following, and at once recognized by the broader, larger leaves with very wide ill-defined nerve. The upper cells are usually more obscure and more irregular. Brotherus describes the leaf-margin as widely recurved and doubly serrate, but this is an error: it is plane except near the apex, where it is sometimes narrowly recurved; and, as mentioned above for *C. pusillum*, it is not doubly serrate, but, like that, slightly and singly denticulate.

It is not uncommon at high altitudes.

2. **Conostomum pusillum** H. f. & W., Fl. N.Z., ii. 88 (1855): Handb. N.Z. Fl., p. 445.

Syn. *C. parvulum* Hampe in Linn., xxviii, 207 (1856). *Philonotis pusilla* Mitt. in Journ. Linn. Soc., Bot., iv, 81 (1859). *Conostomum macrocarpum* R. Br. ter. in Trans. N.Z. Inst. vol. 33, p. 331 (1900). *C. intermedium* R. Br. ter., *op. et. loc. cit.* ? *C. gracile* R. Br. ter., *op. cit.*, p. 332. *C. Bellii* R. Br. ter, *op. et loc. cit.* *C. minutum* R. Br. ter., *op. et loc. cit.*

The leaves in this species are smaller, narrower, with a better-defined narrower nerve. They vary greatly in outline, sometimes being oblong-lanceolate, abruptly and rather sharply cuspidate with the excurrent nerve, sometimes narrowly lanceolate-subulate, gradually and finely acuminate with the nerve excurrent in a long flexuose arista. The margin may be entire except for a few small teeth at apex, or it may be denticulate for some way down. The cells are rectangular and rather pellucid, the upper very variable, sometimes elongate and linear, sometimes shorter and rather irregular, rhomboid-hexagonal. The specimens of *C. macrocarpum* which I received from Brown's herbarium, as well as that in the Christchurch collection, have extremely narrow, almost setaceous leaves, almost exactly like those in some of the minuter species of *Philonotis*, and I was inclined to treat it as a variety, if not as specifically distinct. Curiously, however, Brown described and figures a quite different form of leaf: while in some specimens of *C. pusillum* the leaves approach the form described above so nearly that it can perhaps hardly be treated as anything but an extreme form of this species.

C. (?) gracile was described from specimens not showing peristome, and therefore a little doubtful as to position: the inflorescence, however, and the leaf form and arrangement leave little doubt of its being a *Conostomum*, and, I should think, nearly certainly *C. pusillum*.

It is probably a not uncommon species in alpine situations.

PHILONOTIS Brid., Bryol. univers., ii, p. 15.

Although the characters of the genus are not very easily defined, it is generally easily recognized from *Bartramia* by the habit: the plants are mostly paludal, and the stems generally but not always tall.

A considerable number of the species described under *Bartramia* by R. Brown in the paper already cited belong to *Philonotis*: that they cannot be maintained is no doubt primarily due to the fact that he failed to recognize the highly polymorphous nature of *P. tenuis*, to which five of his species must be reduced.

KEY TO THE SPECIES.

1.	Slender plant with straggling stems and closely whorled branches; leaves minute, glaucous green	1. *scabrifolia.*
	Stems erect, longer, parallel; leaves larger	2
2.	Slender; nerve usually longly excurrent, leaves very finely acuminate, margin usually narrowly recurved	2. *tenuis.*
	Robust; leaves falcate, rather broadly pointed, nerve shortly excurrent, margin plane	3. *australis.*

1. **Philonotis scabrifolia** (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam, Musci, i, 649 (1904).

Syn. *Hypnum scabrifolium* H. f. & W. in Lond. Journ. Bot., iii, 552 (1844). *Bartramia appressa* H. f. & W., Fl. N.Z., ii, 89 (1855). *B. remotifolia* H. f. & W., Fl. Tasman, ii, 193 (1860); Handb. N.Z. Fl. p. 447.

This very distinct little plant is quite different from the other species of the genus. It is (when fresh) of a glaucous green, with almost filiform stems and branches, the latter very markedly whorled below the floral organs: the leaves are minute, ovate-acuminate, with excurrent nerve, and highly papillose at back and margin. The inflorescence is dioicous, the male flower conspicuous and discoid: the fruit often profuse, the capsules unusually large for the size of the plant.

It is widely distributed, and if, as seems probable, the species described from various regions as listed by Brotherus are, as he suspects, all forms of the same thing, it extends around the whole of the South Temperate Zone, and, along the higher Andes, into tropical South America.

2. **Philonotis tenuis** (Tayl.) Jaeg., Adumbr., i, 553.

Syn. *Bartramia tenuis* Tayl. in Phytol., i, 1095 (1844); Fl. N.Z., ii, 89; Handb. N.Z. Fl., p. 448. *B. hapuka* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 143 (1899). *B. Erwinii* R. Br. ter., *op. et loc. cit.* *B. ovalitheca* R. Br. ter., *op. cit.*, p. 144. *B. Joycei* R. Br. ter., *op. et loc. cit.* *B. Turneri* R. Br. ter., *op. cit.*, p. 145.

An extremely variable species in size of plant, density of foliation, size, position, and form of leaf. Occasionally forms occur fully as robust as the more slender forms of *P. australis*. But the difference in leaf-form is then quite marked: in *P. australis* they are falcato-secund, widely lanceolate, shortly acuminate, with usually only shortly excurrent stout nerve: in *P. tenuis* they are not or rarely falcate, much narrower, lanceolate-subulate, finely attenuate, with the narrower nerve running out into a usually very long flexuose arista: the cells are also considerably smaller, the margin usually narrowly recurved, though occasionally quite plane.

I have examined all the species of R. Brown's above listed, and established without any doubt their identity with this variable species. I have little doubt, also, that some of the described Australian species will have to be reduced to *P. tenuis*.

3. **Philonotis australis** (Mitt.) Jaeg., Adumbr., i, 551 (1873–74).

Syn. *Bartramia australis* Mitt. in Hook. f., Handb. N.Z. Fl., p. 448 (1867). *B. pyriformis* R. Br. ter in Trans. N.Z. Inst., vol. 32, p. 146 (1899).

This species is, as described by Mitten, closely allied to *P. calcarea* Schimp.: like that, it has the leaves characteristically falcate-secund, but the cells are narrower, the leaves gradually narrowed from the base, scarcely ovate, the cells narrower, and the margin plane.

I have a specimen of *Bartramia pyriformis* R. Br. ter. which is only *P. australis*.

Var. **surculigera** Dixon in Bull. Torr. Bot. Cl., 42, p. 104 (1915).

I described this striking variety in the above work. Since then I have received a specimen of the same thing from R. Brown's herbarium, gathered in the Port Lyttelton Hills, and undetermined.

BREUTELIA Schimp., Coroll., p. 85.

A genus of fine mosses, differing from *Philonotis* and *Bartramia* mostly in the habit and the usually more or less yellowish colour, but recognizable at once by the leaves, which are always plicate, at least in the basal part, and often above, and are usually of a scarious texture. The male flowers are discoid, and are generally large and conspicuous.

I have made a considerable reduction in the New Zealand species in a former paper (Journ. Bot., liii, 16), where I have gone into the characters in some detail, and I need not repeat the arguments here. As a result I arrange the New Zealand forms under four species, which may be separated thus :—

1.	Very robust ; very densely foliate, leaves subsecund ; habit of *Lycopodium clavatum*	4. *elongata.*
	Leaves less densely arranged, spreading all around the stem	2
2.	Leaves plicate at base only, quite entire	1. *affinis.*
	Leaves plicate above, serrulate	3
3.	Alar cells in several rows, lax, pellucid, upper often shortly rectangular	2. *pendula.*
	Alar cells little differentiated, upper all elongate	3. *Sieberi.*

1. **Breutelia affinis** (Hook.) Mitt. in Kew Journ. Bot., 1856, p. 261.

> Syn. *Bartramia affinis* Hook., Musc. Exot., t. 176 (1820) : Fl. N.Z., ii, 90 ; Handb. N.Z. Fl., p. 448. *Bartramia revisa* R. Br. ter. in Trans. N.Z. Inst., vol., 32, p. 141 (1899). *Bartramia commutata* Hampe in Linn. xl, (1896), p. 307. *Breutelia commutata* Jaeg., Adumbr., ii, 702.

Very distinct from all the other species in the slender habit : the leaves erect and often appressed when dry, not plicate above ; the strongly recurved margin ; and the small, generally ovoid, quite pendulous capsule. The alar cells are very numerous, forming wide bands extending high up the leaf, and are not laxer and more pellucid as in *B. pendula*, but smaller, shorter, subquadrate, and usually rather opaque.

R. Brown (*op. cit.*, p. 138) concludes that the plant of the Handbook cannot be the true *B. affinis* of Hook. Musc. Exot., because the capsule is described and figured there as spherical, while in the Handbook it is described as ovoid ; and he has redescribed this plant as *B. revisa*. The capsules, it is true, are usually ovoid, but they vary somewhat in form. I have seen a subspherical one on the same tuft with one distinctly ovoid. It is partly a question of the condition in which they are gathered ; the capsule shrinks and becomes ovoid unless it is absolutely mature when dried ; and overripe capsules also become narrowed. Hooker's description of the capsule is indeed rather misleading. I have examined the type specimen, and, while one or two of the capsules are decidedly subspherical with a distinct neck, others—in fact, the greater number—are decidedly elongate, oblong-ovoid. Hooker probably considered these—in view of the general character of the genus—as abnormal; but as a matter of fact they are typical of the species: the subspherical form is exceptional.

I am convinced that the Australian *Breutelia commutata* of Hampe is synonymous with *B. affinis*. I have been unable to detect any constant difference. Neither the author nor, so far as I know, any other writer suggests any differentiating character. Rodway, in "The Mosses of Tasmania," comes to a similar conclusion.

2. **Breutelia pendula** (Hook.) Mitt. in Journ. Linn. Soc., Bot., iv, 82 (1859).

Syn. *Bartramia pendula* Hook., Musc. Exot., t. 21 (1818-20); Fl. N.Z. ii, 90; Handb. N.Z. Fl., p. 448. *Bartramia comosa* Mitt., Fl. Tasman., ii, 195 (1860); Handb. N.Z. Fl., p. 449. *Breutelia comosa* Mitt. in Journ. Linn. Soc., Bot., ii, 82 (1859). *Breutelia divaricata* Mitt., *op. et loc. cit.* *Bartramia divaricata* Mitt., Fl. Tasman., ii, 195; Handb. N.Z. Fl., p. 449. *Bartramia consimilis* Hook. f. Handb. N.Z. Fl., p. 449. *Bartramia Bellii* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 142 (1899). *Bartramia Readeriana* Col., *op. cit.*, vol. 17, p. 258 (1884).

A highly variable species, but easily known by the plicate patulous leaves from *B. affinis*; from *B. Sieberi* it can only be known by microscopic characters.

B. Bellii in Brown's herbarium is not to be distinguished from *B. pendula*.

The description of *B. Readeriana*—of which I have seen no specimens—leaves no doubt that it must come under *B. pendula* as understood here.

The capsule is described as pendulous whence the specific name; but, though occasionally so, I find it much more frequently horizontal in all the forms.

Breutelia Sieberi (Hornsch.) Mitt. in Journ. Linn. Soc., Bot., iv, 83 (1859).

Syn. *Bartramia Sieberi* Hornsch. in Sieber M. Nov. Holl., n. 13; Handb. N.Z. Fl., p. 449. *B. Buchanani* R. Br. ter. in Trans. N.Z. Inst., vol. 32, p. 146 (1899).

This species is extremely near to *B. pendula*, and may ultimately have to be united with it. The leaves, however, lack the wide band of pellucid alar cells of *B. pendula*, and the upper cells are all elongate, while in *B. pendula* they become very shortly rectangular above.

I have seen no specimen of *B. Buchanani* R. Br. ter.; but, as the description agrees in every respect with *B. pendula* except that the upper cells are described as linear-oblong I think it may safely be referred here. Brown's own specimen of "*B. Sieberi*" is only *B. pendula*.

I have a specimen collected by James Murray, "Ngauruhoe Volcano, 3 4,000 ft., N.Z." which must be referred here. Besides that and R. Brown's *B. Buchanani* I know of no New Zealand records, but it may have been confused with *B. pendula*.

4. **Breutelia elongata** (H. f. & W.) Mitt. in F. Muell. Fragm. Phyt. austral., xi, 114.

> Syn. *Hypnum elongatum* H. f. & W. in Lond. Journ. Bot., iii, 551 (1844). *Bartramia elongata* Mitt. in Hook. f., Handb. N.Z. Fl., p. 449.

A remarkable and handsome moss, quite distinct from all the other species in the long, robust, flexuose stems, with very densely crowded, strongly falcate leaves; the habit of the plant quite recalls *Lycopodium clavatum*. The fruit, which was not known at the time of the publication of the Handb. N.Z. Fl., is clearly Bartramioid: the seta is very long, at times over 3 in.; the capsule elongate, deeply plicate, somewhat asymmetric, with a distinct neck.

The species has, I think, only been found in the central and southern parts of the South Island.

CALOMNIACEAE.

Calomnion H. f. & W., Fl. N.Z., ii. 97.

This, the sole genus of the small family, consists of three species only, the New Zealand species being endemic, the remaining two inhabiting Samoa and Tahiti respectively. They are delicate plants, with a creeping radiculose primary stem, and simple slender secondary stems, often leafless, or with very minute distant leaves, for a considerable distance upwards. The leaves are arranged in three rows, the two lateral distichous, the ventral much smaller; all more or less widely ovate; the perichaetial ones much longer and narrower, the seta terminal; fruit oblong-cylindrical, gymnostomous.

Calomnion laetum H. f. & W., Fl. N.Z., ii. 97 (1855); Handb. N.Z. Fl., p. 490.

Growing almost exclusively on the trunks of tree-ferns, in both North and South Islands.

POLYTRICHACEAE.

Key to the Genera (so far as applies to the New Zealand species).

1.	Stems tall, dendroidly branched	*Dendroligotrichum.*
	Stems not dendroid	2
2.	Calyptra naked or sparsely setose	3
	Calyptra densely hairy	6
3.	Lamellae few (or very indistinct)	4
	Lamellae numerous	5
4.	Leaves unbordered, subentire	*Oligotrichum.*
	Leaves bordered, with spinose teeth	*Catharinaea.*
5.	Capsule terete	*Psilopilum.*
	Capsule 2-angled (convex or plane on one face, concave on the other)	*Polytrichadelphus.*
6.	Capsule terete, apophysis O; stomata wanting	*Pogonatum.*
	Capsule angled (except *P. alpinum*); apophysis and stomata present	*Polytrichum.*

CATHARINEAEA Ehrh. in Hannov. Mag., 1780, p. 933.

Syn. *Atrichum* P. Beauv., Prodr., p. 42.

Catharinaea Muelleri Hampe & C. M. in Linn., 26, p. 500 (1853).

Syn. *Polytrichum angustatum* H. f. & W., Fl. N.Z., ii, 94, and Hook. F., Handb. N.Z. Fl., p. 453 (nec *P. angustatum* Brid.). *Atrichum ligulatum* Mitt. in Kew Journ. Bot., 8 (1856), p. 262. *Catharinaea lepto-cylindrica* C. M. in Hedwig., xxxvi, 338 (1897).

The New Zealand and Australasian species differs slightly but distinctly from the *C. angustata* of the Northern Hemisphere, in the fewer lamellae, larger cells, &c. It is at once known from all the other New Zealand plants of this family by the strongly undulate leaves, much crisped when dry, with narrow, cartilaginous border bigeminately spinulose above, and the very long, narrow, cylindrical capsule.

It is widely distributed throughout New Zealand.

OLIGOTRICHUM Lam. & De Cand., Flor. franc., iii, ed. ii, p. 491.

Oligotrichum tenuirostre (Hook.) Jaeg., Adumbr., i, 699. *Polytrichum tenuirostre* Hook., Musc. exot., t. 75 (1818); Fl. N.Z., ii, 94; Handb. N.Z. Fl., p. 453.

Readily known by the terete, oblong, slightly gibbous capsule with long, fine, curved beak, and the entire leaves with very inconspicuous, almost obsolete lamellae. The calyptra is very fugacious, narrow, cucullate, quite smooth except for a few short bristles at the extreme apex.

I have it from both North and South Islands.

PSILOPILUM Brid., Bryol. univ., ii, 95.

This is a small well-marked genus of about fourteen species, inhabiting the circumpolar zones of both hemispheres, and extending to the sub-antarctic regions, with one or two species in Australia and three or four on the higher mountains of tropical South America.

The lamellae are usually numerous, though in some species very few; they are sinuose in the upper part of the leaf, which is usually very concave with inflexed entire margins, and of softer texture with laxer cells than in *Pogonatum* and *Polytrichum*. The capsule is terete, rather wide and short, often curved and gibbous; the calyptra naked or slightly setulose at apex; the peristome sometimes wanting, and always less highly developed than in *Polytrichum*. The capsules are mostly rather like those of *Oligotrichum tenuirostre*, but larger, wider, and with a shorter beak.

The following key is mostly based on Botherus's arrangement:

1.	Peristome wanting	1. *Bellii.*
	Peristome present	2
2.	Leaves sharply toothed	2. *crispulum.*
	Leaves entire or slightly denticulate at apex	3. *australe.*

1. **Psilopilum Belli** Broth. in Oefv. af Finska Vet.-Soc., Foerh., xl, 179 (1898).

I have not seen this species, which is described as robust, with dense leaves, somewhat crisped when dry, (about 5 mm. long, oblong-lingulate, obtuse, sharply, unequally serrate; the nerve ceasing below apex, somewhat toothed at back above, lamellae 30–36, low, 2–3-seriate, the upper cells lax, pellucid, 20–25μ wide; seta short, 1·5 cm. high; capsule gymnostomous.

I do not know of any localities but those of the first collecting, by Bell, on Pine Hill and Mount Cargill, near Dunedin.

2. Psilopilum crispulum (H. f. & W.) Jaeg., Adumbr., i, 697.

Syn. *Polytrichum crispulum* H. f. & W., Fl. N.Z., ii, 85; Handb. N.Z. Fl., p. 453.

This species is known from *P. australe* by the longer, larger, softer leaves, much crisped when dry, and closely and sharply toothed above; from *P. Bellii* by the peristomate capsule and much smaller leaf-cells (10–15μ).

It occurs in mountainous districts of both North and South Islands, but is apparently rarer than the next species.

3. Psilopilum australe (H. f. & W.) Jaeg., Adumbr., i, 697.

Syn. *Polytrichum australe* H. f. & W., Fl. N.Z., ii, 95; Handb. N.Z. Fl., p. 454.

The stems are shorter than in the previous species, with the leaves very densely comose, shorter and much more rigid when dry, strongly incurved rather than crisped, and the margin is nearly or quite entire. It occurs throughout New Zealand in mountainous regions.

Both species are also found in Tasmania.

DENDROLIGOTRICHUM Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 679.

A monotypic genus (see below), consisting of one magnificent species, having robust stems sometimes 1½ ft. high, simple for the greater part of its length and naked except for a few appressed scale-like leaves, in the upper part dendroidly ramose into numerous branches several inches long, more or less densely foliate with very long leaves much crisped when dry. The fruit is terminal on one or more of these branches (sometimes prolonged later so that the fruit appears lateral), with setae 2 in. long or more, and capsules resembling those of *Polytrichum alpinum*, but with calyptra glabrous or nearly so. The nerve has numerous low, not sinuose lamellae on its upper surface, and 2–3 toothed lamellae at back.

Dendroligotrichum dendroides (Hedw.) Broth., *op. et loc. cit.*

Syn. *Polytrichum dendroides* Hedw., Sp. M., p. 102 (1801): Fl. N.Z., ii, 96; Handb. N.Z. Fl., p. 454. *Catharinaea microdendron* C. M. in Hedwig., xxxvi, 339 (1897). *Polytrichum tongariroense* Col. in Trans, N.Z. Inst., vol. 20, p. 239 (1887).

One of the finest of the New Zealand mosses, and, I gather, widely distributed. It varies considerably in length of branches and leaves. It is, I have no doubt, either one of the short, dense forms of this, or a polycephalic state of a *Polytrichum*, which Mitten referred to *Polytrichum squamosum* H. f. & W., a Fuegian plant not otherwise known from New Zealand (see Handb. N.Z. Fl., p. 454). There are no specimens of Jupp's at Kew, nor in Mitten's herbarium at New York. A plant of Hector's (62, Otago, 1864) is not at all unlike the Fuegian moss, but is undoubtedly only one of these dwarfed forms of *D. dendroides*. *P. squamosum* must be excluded from the New Zealand flora. Whether the Fuegian plant itself is a *Dendroligotrichum* is, I think, exceedingly doubtful; the only character supporting the view is the dendroid habit—fruit has not been found. The leaf form and direction, the lamellae, &c., are quite distinct from *D. dendroides*. Abnormal states of several species of *Polytrichum* occur, such as *P. alpinum* and *P. commune* (it is, no doubt, such a state of the latter species that has given rise to the erroneous record of *Dendroligotrichum* in South Africa); and I strongly suspect that *P. squamosum* is a similar development either of *P. commune* or of some allied species;

although it would seem to have developed into something more pronounced and more permanent than is the case with the above-mentioned states.

Colenso's plants of *P. tongariroense* at Kew show no difference whatever from *D. dendroides.*

POLYTRICHADELPHUS Mitt. in Journ. Linn. Soc., iv, 97 (1859).

Polytrichadelphus magellanicus (L.) Mitt., *op. et. loc. cit.*

> Syn. *Polytrichum magellanicum* L., Suppl., pl. p. 449, *et* Hedw., Sp. M., p. 101 (1801) ; Fl. N.Z., ii, 95 ; Handb. N.Z. Fl., p. 454. *P. ruahinicum* Col. in Trans. N.Z. Inst., vol. 18, p. 282 (1885). *P. polycarpum* Col., *op. cit.*, vol. 19, p. 276 (1886).

This plant has the foliation almost like that of *Polytrichum alpinum*, and may easily be passed over as a *Polytrichum*. The calyptra, however, is only slightly hairy, and may even be glabrous below ; and the capsule is of a very different form, being more of the build of *Buxbaumia* than of any of the genera of this family ; it is inclined or horizontal, two-angled or two-winged, the angles being lateral or horizontal ; of the two faces between the wings, one is plane or convex, the other concave (often deeply so when ripe) ; the transverse section of the capsle therefore being that of a crescent, or convexo-concave lens.

The descriptions vary as to whether the concave side is the upper or the lower. The Handb. N.Z. Fl. describes the capsule as " flat above, concave below " ; but all the other authors I have consulted where this is defined give the contrary position ; and this is no doubt correct. When the capsules are overmature, however, their form is often obscured, especially in pressed herbarium specimens, and the same may be the case with unripe capsules.

Some discrepancy also occurs in descriptions as to the calyptra, whether hairy or not below. In one specimen, at least, in my herbarium the quite young calyptra is very bristly, but it appears to lose this character as it matures, except at the extreme apex. This may account for the discrepancy referred to.

Colenso's two species placed in the synonymy above have been suspected by Brotherus to belong to *P. magellanicus*, and my examination of Colenso's specimens at Kew entirely confirms this suspicion. In *P. ruahinicum* the seta is abnormally long, but is approached by other specimens in the collection ; there are no other differences. Most of the characters on which Colenso bases his *P. polycarpum* are quite characteristic of *P. magellanicus* *e.g.*, length of calyptra, orbicular mouth of capsule, &c.

P. magellanicus is a fairly common moss throughout New Zealand.

POGONATUM P. Beauv., Prodr., p. 84.

Pogonatum subulatum (Menz.) Brid., Bry. univ., ii, 122 (1827).

> Syn. *Polytrichum subulatum* Menz. in Trans. Linn. Soc., iv, 303 (1798). *P. tortile* H. f. & W., Fl. N.Z., ii, 96 ; *et* Handb. N.Z. Fl., p. 454 (nec *P. tortile* Sw.). *P. australasicum* Hampe & C. M. in Linn., xxvi, 500 (1853). *Pogonatum australasicum* Jaeg., Adumbr., i, 718. *Polytrichum nano-urnigerum* C. M. in Hedwig., xxxvi, 340 (1897). *P. maoriae* C. M., *op. cit.*, p. 341.

There seems no adequate reason why Menzies' name should have been dropped in favour of *P. australasicum* (Hampe & C. M.), which is certainly identical with the New Zealand species. The Australasian plant appears to differ appreciably, though certainly not widely, from the West Indian

P. tortile (Sw.), which has a shorter, more inclined and asymmetrical capsule, and shorter lid.

As is the case with some allied species in India, the ribbing of the capsule is extremely variable, and, while partially connected with the degree of maturity, is to some extent quite independent of this. I have seen ripe capsules of the same age on the same gathering some of which were absolutely smooth, others with faint traces of ribs, and others distinctly six-ribbed.

The cylindrical, nearly symmetrical capsule, terete or faintly ribbed, together with the short, widely pointed leaves, densely lamellate, separates it at once from the species of *Polytrichum* as well as from the plants of the allied genera.

POLYTRICHUM (Dill.) L., Syst. Nat., ed. i (1735).

KEY TO THE SPECIES.

1. Margin of leaf membranous, strongly inflected, quite entire .. 2. *juniperinum.*
Margin serrate 2
2. Capsule terete, more or less inclined, usually gibbous .. .. 1. *alpinum.*
Capsule angled 3
3. Apical cell of lamellae in section bifid or grooved ; cells of lamina about 10–12μ wide .. .. 3. *commune.*
Apical cell of lamellae similar to the lower ; leaf-cells 15–18μ .. 4. *gracile.*

All four species are such well-known and early described ones that there is no need to do more than briefly refer to them.

1. **Polytrichum alpinum** L., Handb. N.Z. Fl., p. 455.

Syn. *Pogonatum alpinum* Roehl et auct. plur.

Apparently rare in New Zealand.

2. **Polytrichum juniperinum** Willd., Fl. berol. Prodr., p. 305 (1787) ; Fl. N.Z., ii, 96 ; Handb. N.Z. Fl., p. 455.

Syn. *P. rubiginosum* C. M. in Hedwig., xxxvi, 345 (1899).

P. juniperinum often takes on a reddish tint, and *P. rubiginosum* is simply one of these forms.

This and the next species are practically cosmopolitan, and are widely distributed in New Zealand.

3. **Polytrichum commune** L., Fl. N.Z., ii, 96 ; Handb. N.Z. Fl., p. 455.

Very variable in size and habit, length and direction of leaf, development of perichaetium, and size of capsule.

4. **Polytrichum gracile** Menzies in Trans. Linn. Soc., iv, 73 (1798) ; Handb. N.Z. Fl., p. 455.

This appears to be very rare in New Zealand. I have received no specimens from there ; there are only two in the Kew collection, both *leg.* Sinclair and Haast, and probably representing a single gathering.

DAWSONIACEAE.

DAWSONIA R. Br. in Trans. Linn. Soc., x, 316 (1811).

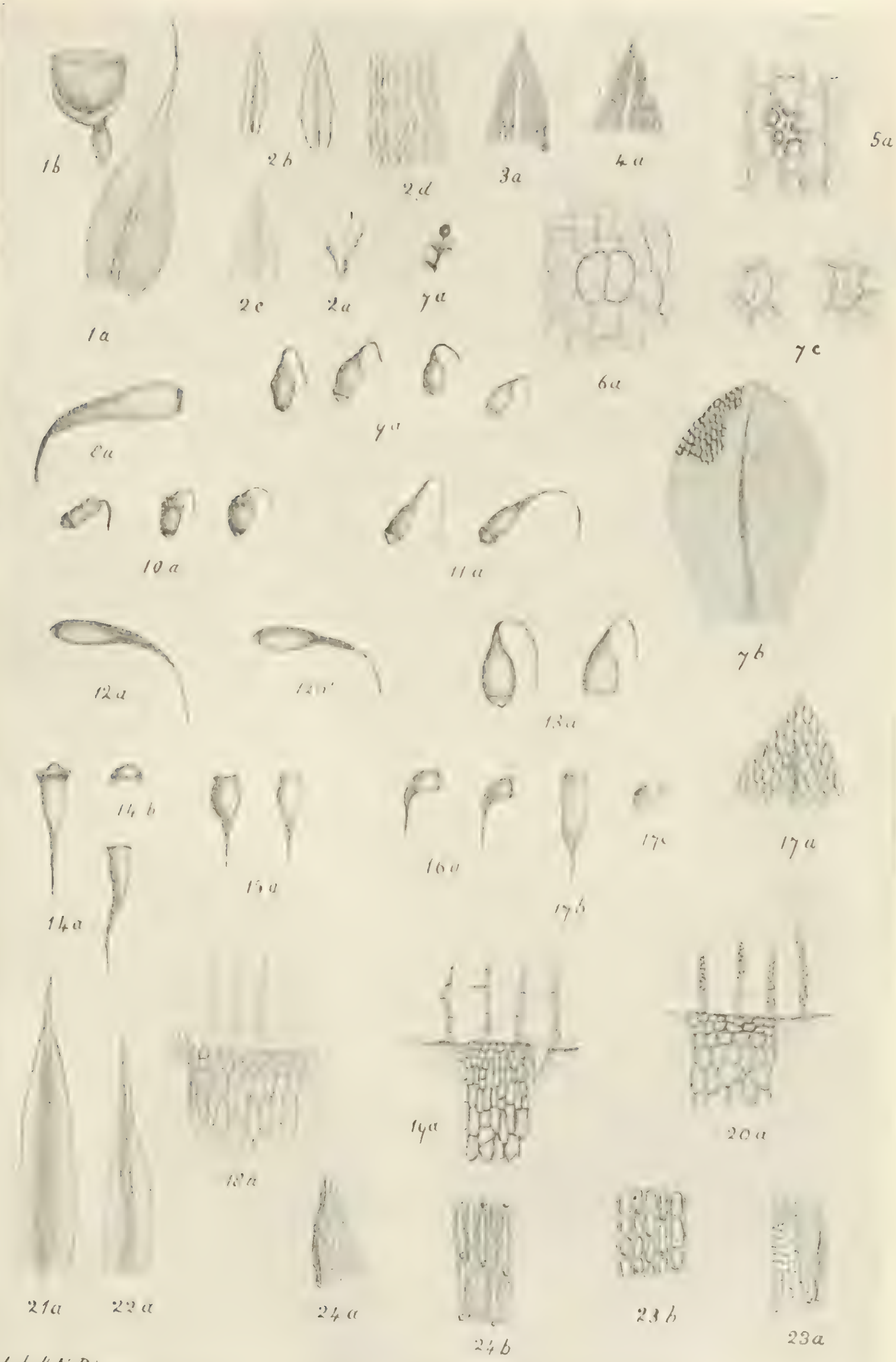
Dawsonia superba Grev. in Ann. & Mag. Nat. Hist., 1847, p. 226 ; Fl. N.Z., ii, 97 ; Handb. N.Z. Fl., p. 455.

This magnificent moss is too well known to need description. It is found in both North and South Islands, and is probably fairly common ; it extends to Tasmania and Australia. In Papua it is represented by *D. grandis* Schlieph. & Geh. ; in Borneo by *D. altissima* Geh.

EXPLANATION OF PLATE IX.

Fig. 1. *Grimmia argentea.* *a*, perichaetial leaf, × 10. *b*, capsule, × 10.
Fig. 2. *Zygodon subminutus.* *a*, plant, × 2. *b*, leaves, × 20. *c*, leaf-apex, × 40. *d*, upper cells, × 200.
Fig. 3. *Z. anomalus.* *a*, leaf-apex, × 50.
Fig. 4. *Z. Reinwardtii.* *a*, leaf-apex, × 50.
Fig. 5. *Orthotrichum calvescens.* *a*, stoma of capsule wall, × 200.
Fig. 6. *O. austro-pulchellum.* *a*, stoma of capsule wall, × 200.
Fig. 7. *Physcomitridium Readeri.* *a*, plant × 2. *b*, leaf, × 20. *c*, two stomata, × 200.
Fig. 8. *Bryum mucronatum.* *a*, capsule, × 4.
Fig. 9. *B. dichotomum.* *a*, capsule, × 4.
Fig. 10. *B. pachytheca.* *a*, capsule, × 4.
Fig. 11. *B. chrysoneuron.* *a*, capsule, × 4.
Fig. 12. *B. curvicollum.* *a*, a^1, capsules, × 4.
Fig. 13. *B. appressifolium.* *a*, capsule, × 4.
Fig. 14. *Funaria subattenuata.* *a*, capsule (dry), × 4. *b*, lid (moist), × 4.
Fig. 15. *F. cuspidata.* *a*, capsule, × 4.
Fig. 16. *F. glabra.* *a*, capsule, × 4.
Fig. 17. *F. Helmsii.* *a*, leaf-apex. *b*, capsule, × 4. *c*, lid (moist), × 4.
Fig. 18. *Mielichhoferia Eckloni.* *a*, exothecium cells and peristome teeth, × 50.
Fig. 19. *M. australis.* *a*, exothecium cells and peristome teeth, × 50.
Fig. 20. *M. tenuiseta.* *a*, exothecium cells and peristome teeth × 50.
Fig. 21. *Conostomum australe.* *a*, leaf, × 20.
Fig. 22. *C. pusillum.* *a*, leaf, × 20.
Fig. 23. *Breutelia pendula.* *a*, alar cells, × 40. *b*, upper cells, × 200.
Fig. 24. *B. Sieberi.* *a*, alar cells, × 40. *b*, upper cells, × 200.

PLATE IX.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del. H. N. Dixon

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NEW ZEALAND INSTITUTE.

BULLETIN No. 3.

STUDIES IN THE

BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF
ROBERT BROWN.

BY H. N. DIXON, M.A., F.L.S.

PART V.

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PART V.

PLEUROCARPI.

ERPODIACEAE.

Aulacopilum Wils. in Lond. Journ. Bot. vii, 90 (1848).

A. glaucum Wils. op. et loc. cit.; Fl. N.Z., ii. 98; Handb. N.Z. Fl., p. 456.

A minute, corticolous plant, which may have been overlooked, but appears to be very rare; I have not heard of any records since the original by Colenso. The capsules are rather like those of Fabronia, but are gymnostomous, and the conspicuous, striated and contorted calyptra, embracing the whole capsule, is very distinct, as are the broad, nerveless, papillose leaves.

Mitten attributes the species to S. Africa, and it is indeed a very moot point whether the African and Indian plants, as well as the S. American be really distinct from *A. glaucum*. As far as I am aware the supposed differences entirely consist of a slight modification in the leaf apex, which in the New Zealand species is acute and concolorous, in the African very shortly piliferous and hyaline, in *A. tumidulum* Thw. & Mitt., according to Mitten, broader and less acuminate than in *A. glaucum*. The New Zealand plant, however, has the leaves frequently, perhaps normally tipped with a single fine hyaline cell, and is occasionally prolonged into a short but distinct hyaline hair-point; and I am unable to detect any difference whatever in the Ceylonese *A. tumidulum*. The S. African plant has the leaves normally with a distinct but very short hyaline hair-point, thus differing somewhat from *A. glaucum;* but this is by no means universal, and at the best forms but a minor character. In any case *A. incanum* Mitt. is identical with *A. trichophyllum* Aongstr.; and I greatly doubt whether we have really to deal with anything but slight racial modifications—at the most—of *A. glaucum*, including probably *A. abbreviatum* Mitt., but of course excluding the Australian *A. Hodgkinsoniae,* which is quite distinct.

HEDWIGIACEAE.

Hedwigia Ehrh. in Hannov. Mag. 1781, No. 69, p. 1095.

Hedwigia albicans (Web.) Lindb. Musc. Scand. 40 (1879).

Syn. *H. ciliata* Ehrh. et auct. plur.; Handb. N.Z. Fl., p. 423. *H. microcyathea* (C.M.) Par. Ind. p. 554. *Pilotrichum microcyatheum* C.M. in Bot. Zeit. 1851, p. 564.

A common and variable rupestral species on siliceous rocks, almost cosmopolitan. Mitten reduced *H. microcyathea* (C.M.) to this species, and a New Zealand specimen in my herbarium identified as such by C. Mueller himself is certainly in no way different from the ordinary forms of *H. albicans*.

Hedwigidium Bry. eur. fasc. 29-30 (1846).

Hedwigidium imberbe (Sm.) Bry. eur. loc. cit.

Syn. *Gymnostomum imberbe* Sm. Engl. Bot., t. 2237. *Braunia Novae-Seelandiae* C.M. & Beck. in Trans. N.Z. Inst. xxvi, 275 (1893). *Schistidium Drummondii* Tayl. in Lond. Journ. Bot., v, 37 (1846). *Neckera Drummondii* C.M. Syn. ii, 106. *Hedwigidium Drummondii* Jaeg. Adumbr. ii. 89.

Hedwigidium differs from Hedwigia principally in the presence of microphyllous, stoloniform shoots, the leaves muticous or very rarely shortly hyaline pointed (though the leaves on the stoloniform shoots may be piliferous), the striate capsule, and the perichaetial leaves not ciliate.

Braunia novae-seelandiae C.M. & Beck. is certainly referable here, as Mitten suspected. I have a specimen of the original plant from Beckett's herbarium, which is sterile, but agrees exactly with the usual European forms of *H. imberbe;* it is in fact more exactly identical with these than are some other New Zealand and Tasmanian forms, which often have longer and more acuminate leaves, not or scarcely striate when dry. This, however, occurs equally in our northern plant; I have forms quite agreeing from Luchon, in the Pyrenees.

The Kew specimen of *B. novae-seelandiae* shows some leaves with very decided though short, glistening, occasionally reddish, cuspidate points, quite reminiscent of Rhacocarpus; this however is exceptional, and most of the leaves are normal. This character occurs occasionally in other Australasian specimens of *H. imberbe*, notably in one or two specimens at Kew of the form described as *H. Drummondii* (Tayl.) Jaeg. It is not, however, correlated with any other character, and is only sporadic. *H. Drummondii* was based practically entirely on the supposed nerved leaves, but as Wilson has pointed out, this is fallacious. The narrow-linear median basal cells when highly coloured and extending rather high in the leaf give the appearance of a nerve, and this has led to the erroneous description of *H. Drummondii* as having nerved leaves. In other respects it agrees with the normal forms of *H. imberbe*. It appears to fruit more frequently in Australasia than in Europe; it fruits, however, much less commonly than *Hedwigia albicans*. It is probably not very common in New Zealand.

RHACOCARPUS Lindb. in Oefv. K. Vet.-Akad. Foerh., 1863, p. 603.

Rhacocarpus australis (Hampe) Par. Ind., p. 1068 (1897).

Syn. *Harrisonia australis* Hampe in Linn. xxx, 636 (1859-60).
Hedwigia Humboldtii β australis H.f. & W., Fl. N.Z., ii, 93.
Braunia Humboldtii Hook. f, Handb. N.Z. Fl., p. 423.

This fine rupestral species is fairly common and often abundant. The red, glossy hair-points of the leaves form a very beautiful microscopic object, and the plant is at once recognizable under the lens by these alone. The New Zealand plant was formerly considered to be identical with the wide-spread *R. Humboldtii*; it is now separated, on rather slight characters drawn from the perichaetial leaves, but it may be doubted whether it be more than a slight racial segregate.

CLIMACIACEAE.

CLIMACIUM Web. & Mohr. Reise durch Schweden, p. 96 (1804).

Climacium dendroides (Dill.) Web. & Mohr, loc. cit.

Syn. *Climacium novae-seelandiae* C.M. & Beck. in Trans. N.Z. Inst., xxv., 292 (1892).

A very common plant in the north temperate zone, but little known in New Zealand. It rarely fruits, and the sterile plant is alone, I believe, found here. In its dendroid habit it is perhaps most like *Sciadocladus Kerrii*, and might indeed be passed over as a dense form of that; the leaves in the Climacium, however, are much more closely imbricated, shorter and wider at the points, with a shorter nerve, ceasing distinctly below the apex, and quite different marginal serration.

The New Zealand plant differs in no respect from that of the northern hemisphere. Stress is laid in the description (Trans. N.Z. Inst., loc. cit.) on the sulcate leaves, but they are no more so than frequently, perhaps normally is the case with our British plant. It is one of those cases, like Saelania, where a plant of the northern hemisphere appears in New Zealand with no further distribution in the Southern Hemisphere.

CRYPHAEACEAE.

The species united under Cryphaea by the older writers are divided by Brotherus into several genera in the "Musci," and the New Zealand species fall into three of these, Cryphaea, Cryphidium and Dendrocryphaea. The characters by which these latter genera are separated appear to me very slight and elusive—not to say illusory, at any rate as concerns the New Zealand species. They are both separated by Brotherus from Cryphaea principally as having the ♀ flower and subsequently the perichaetium terminal on a shorter or longer branch having foliage leaves at its base, while in Cryphaea the perichaetia are sessile on the stem or branches. A glance at the figures, however, in Brotherus' work will show that in e.g. *Cryphidium Muelleri* (Hampe) there is no such difference; the perichaetia are similar and similarly placed to those as figured for e.g. *Cryphaea protensa* and *C. attenuata;* and the same is the case with *Dendrocryphaea tasmanica*, or even more so; for in *C. dilatata* and other species of Cryphidium the perichaetia are frequently terminal on long branches, even while others on the same plant are sessile; but in *C. tasmanica* the dense lateral sessile perichaetia are one of the most striking features of the species. I prefer therefore to keep all the species under Cryphaea.

Fleischer (Hedwig. lv, pp. 280 sqq.) in revising the genera in C. Mueller's herbarium, separates Cyptodon Par. & Schimp. from Cryphidium (Mitt.) Jaeg. (which Brotherus had united), since the type of Cryphidium (Mitt.) belongs to the Leptodontaceae; the Australasian species are retained under Cyptodon. If the New Zealand species placed by Brotherus under Cryphidium are to be separated from Cryphaea, they must therefore be placed under Cyptodon.

KEY.

1	Leaves narrowly acuminate, finely tapering	1. *tenella*	
	Leaves broadly ovate, obtuse or widely acute	....	2
2	Leaf margin almost plane		3
	Margin widely reflexed below, perichaetial leaves toothed	4. *chlorophyllosa*	
3	Perichaetial leaves entire	2. *dilatata*	
	Perichaetial leaves toothed		4
4	Slender, flexuose, much branched plants; fruiting branches often elongate	3. *confusa*	
	Rigid, stouter, shorter plants with short branches, and dense, often biseriate, short fruiting branches	5. *tasmanica*	

1. **Cryphaea tenella** (Schwaegr.) Hornsch. e C. Mueller in Linn., xviii. 678 (1844).

Syn. *Neckera tenella* Schwaegr. Suppl. ii, Pt. 2, p. 163, t. 198 (1826). *C. consimilis* Mont. in Ann. sc. nat. 1845, p. 100; Fl. N.Z. ii, 101. *C. parvula* Mitt. in Hook. f., Handb. N.Z. Fl., p. 460. *C. acuminata* H. f. & W., Fl. N.Z, ii, 102; Handb. N.Z. Fl., p. 461. *C. pusilla* C.M. in Hedwig. xli, 130 (1902).

At once separated from the remaining species by the slender rigid habit, the narrow leaves, narrowly and finely acuminate, and the finely setaceous points of the perichaetial leaves.

The complicated synonymy is due principally to the Fl. N.Z. There the authors refer New Zealand plants to *C. consimilis* Mont., a species known already from S. America. They also describe a new species, *C. acuminata,* but they do not compare it with the former species, nor does the description suggest any differences, except that the lid in *C. consimilis* is described as "conico obtuso," and in *C. acuminata* as "conico rostellato."

In Hooker's herbarium none of the New Zealand specimens are placed under *C. consimilis,* all under *C. acuminata.* The only Australasian specimen labelled *C. consimilis* is a Tasmanian plant "Oldfield; 0,49," determined by Mitten. The lid in this is identical with that of *C. acuminata.* It looks as if Hooker and Wilson had later recognized that there was only one species involved, but considered it different from the S. American *C. consimilis,* and had placed the plants therefore all under *C. acuminata.*

Under *C. consimilis* in the Fl. N.Z. the authors remark "*Neckera tenella* Schwaegr. Suppl. t. 198 may be the same, but if so is incorrectly figured." This probably refers to the figure of the single leaf, which is drawn with the nerve apparently longly excurrent; and on this ground Brotherus retains the New Zealand species (*C. acuminata*) with "nerve ceasing below apex" and *C. tenella* with "nerve excurrent."

But a species cannot be founded on a bad drawing; the more especially when the description contradicts the drawing; and Schwaegrichen distinctly states that the nerve is *continued into the narrow part of the leaf* (that is, the acumen) *and sometimes to the apex;* and the enlarged figure of part of the acumen shows the nerve vanishing. C. Mueller, it may be added, in Linn. xviii, 678, having authentic specimens of the Australian *C. tenella* before him, emphasizes the fact of the nerve being non-excurrent in that species. It is quite clear that *C. acuminata* cannot be separated on the ground of the nerve being non-excurrent.

The nerve in the Australian *C. tenella* as a fact is exactly the same as in the New Zealand plants; i.e. in the more robust stem leaves it passes distinctly into the acumen and becomes lost before the apex; in the smaller and branch leaves it vanishes at the base of the acumen or often below it.

Brotherus separates the S. American *C. consimilis* from the Australasian species by the longer peristome, .5 mm. as against .35mm. in *C. acuminata.* I have not, however, found any difference in the length of the peristome in the American plant (in *C. tenella* the peristome varies from .3mm. to .4mm.) and I am not aware of any other suggested difference, and am unable myself to detect any.

C. parvula Mitt. must also enter the synonymy. Mitten had no intention of creating a third Australasian species, but simply of renaming the N.Z. plant, on the supposition that it was different from the American species, *C. consimilis.*

Fleischer, it is true, in revising the genera of C. Mueller's herbarium (Hedwig. lv, 284) considers "*C. chlorophyllosa* C.M., n. sp. ined.," as identical with *C. parvula* Mitt., and re-names it *Cyptodon parvulus* (Mitt.) Fleisch. *C. chlorophyllosa* however is not *ined.;* it is published in Hedwig., xli, 131 (1902), and it is certainly not identical with Mitten's own specimens of *C. parvula*, which are quite identical with *C. tenella*, and not a Cyptodon. Fleischer must I think have been misled by a wrongly named specimen of *C. parvula*, and C. Mueller's name should be retained, whether in Cryphaea or Cyptodon.

I have carefully studied numerous specimens of the New Zealand *C. tenella*, which appeared to show, with much polymorphy as to size, certain variations in the perichaetia and peristome characters; the perichaetial bracts may be either gradually tapering or very abruptly setaceous from a broad base, obtuse or even retuse at the apex, with the arista either erect or markedly spreading. The peristome teeth may be sparsely papillose so as to be almost translucent, or densely papillose and opaque, and the same applies to the inner processes; they also vary in length from under .3mm. to fully .4mm. None of these variations, however, appear to be correlated with one another or with the size of the plant; nor are they at all well defined, and they do not afford a basis for even a varietal segregation.

C. tenella is a common species on trees.

2. **Cryphaea dilatata** H.f. & W., Fl. N.Z. ii, 102 (1855); Handb. N.Z. Fl., p. 461.

Syn. *Cyptodon dilatatus* Par. & Schimp. e Par. Ind., p. 310. *Cryphidium dilatatum* Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 743. *Dendropogon Muelleri* Hampe in Linn. xxvii (1856) 212. *Cryphidium Muelleri* Broth., op. et loc. cit.

This and the following species are much alike in habit, and only to be distinguished by microscopic examination. The stems are elongate, more or less pendulous, flexuose—not rigid as in *C. tenella*—and have a broadly ovate, suborbicular leaf, with a short, broad, often obtuse apex, and a stout nerve almost percurrent.

The present species scarcely differs from the next except in the leaves being almost entire, only very finely crenulate above, and the perichaetial leaves being quite entire.

The perichaetia are often terminal on quite elongate branches, but the fertile shoots may be, even on the same plant, quite short and similar to those of most species of Cryphaea. I can scarcely think the separation from Cryphaea on this ground is justified.

The nerve in *C. dilatata* nearly always ends abruptly and almost without any narrowing, just below the apex.

I have examined original specimens of *Dendropogon Muelleri* Hampe, and can find no differences whatever from *C. dilatata*.

An allied species is *C. ovalifolia* (C.M.) Jaeg., an Australian plant; a much misunderstood species, often confused with *C. dilatata*. It has more widely spreading leaves, very broadly rounded at apex, and with nerve tapering above, and ceasing decidedly lower in the leaf. To this species must certainly be reduced *C. crenulata* Mitt., and *C. squarrosula* Hampe; I have examined authentic specimens of both and find them identical with *C. ovalifolia*.

C. dilatata is I believe rare in New Zealand. I have several specimens so named, but they nearly all belong to the following species. (Both appear to be subaquatic, or riparian plants). It occurs also in Australia.

3. **Cryphaea confusa** Dixon sp. nov. (Plate X, fig. 1.)*

A *C. dilatata* proxima differt, foliis plerumque apice paullo angustioribus, subacutis, plus minusve distincte, irregulariter serrulatis, bracteisque perichaetialibus distincte, saepe argute denticulatis.

This plant has been much confused with *C. dilatata*; in fact, all the New Zealand specimens I have received under that name belong here. It is scarcely distinguishable in habit and leaf form, but is readily known by the perichaetial leaves, which are there entire, but here more or less distinctly toothed. The toothing may be faint, but is more often very pronounced and even coarse. It is usually confined to the lamina margin, but the broad, stout, rigid arista formed of the wide, excurrent nerve is sometimes itself toothed. The differences in the foliage leaves described, though slight, are I think fairly constant, and often quite pronounced.

I have *C. confusa* from several localities in the South I. "*Cryphaea Muelleri* Hampe.—*C. dilatata* Mitt.; on trees overhanging streams, Clinton Valley, Otago," coll. T. W. Naylor Beckett; Clinton Valley, Te Anau, coll. D. Petrie; and River Bank, Clinton, coll. R. Brown ter. Specimens from Mitten's herbarium, leg. Kirk, Nos. 223-227, as *C. dilatata* were probably collected in the North I., but this may not have been the case. A further plant from Ballina, N.S.W. (Watts, 658) issued as *C. ovalifolia* C.M., also belongs here.

4. **Cryphaea chlorophyllosa** C.M. in Hedwig. xli, 131 (1902). [Plate X, fig. 2.]

Syn. *Cyptodon parvulus* Fleisch. in Hedwig. lv, 284 (1914), *nec Cryphaea parvula* Mitt.

As observed above under *C. tenella*, Mitten's *C. parvula* is certainly not identical with the plant described by C. Mueller as *C. chlorophyllosa*. I have not seen the original plant described by C. Mueller (Greymouth, 1885, coll. Helms), but from the description I can have no doubt that it is identical with a specimen I have received from R. Brown's herbarium, unnamed. In habit it is somewhat intermediate between the two preceding species and *C. tenella*, being more slender than the former, more rigid, less branched. In the toothed perichaetial leaves it resembles *C. confusa*, but differs from both that and *C. dilatata* in the leaves, which are narrower, more elongate, with a narrower, subacute, often half-twisted point; the margin is widely recurved below when moist, the nerve deeply carinate, generally more tapering above, and ceasing some little way below the apex; the leaves are more or less longitudinally plicate. In *C. dilatata* and *C. confusa* the leaf margin is recurved when dry, but not or scarcely when moist. The peristome is delicate and fragile, the teeth and processes narrow, smooth.

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* The plate will be published with Part VI.

C. Mueller in his description does not refer to the half-twisted apex, but all the other characters above described are referred to in his description.

Brown's locality is West Coast, South I., Jan., 1902. I have also received it from Mt. Bruce, Wairarapa, North I., coll. W. Gray (No. 273).

5. **Cryphaea tasmanica** Mitt. in Fl. Tasm., ii 204 (1858), and Journ. Linn. Soc., Bot., iv, 90 (1859); Handb. N.Z. Fl., p. 461.

Syn. *Dendrocryphaea tasmanica* Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 744. *Cryphaea novae-zelandiae* Col. in Trans. N.Z. Inst., vol. 28, p. 618 (1896).

An aquatic or semi-aquatic species, like *C. dilatata* and *C. confusa*, but of very different habit; usually dull, dark green, with shorter, very rigid stems, which are not much branched, but are usually densely clad with the perichaetial branches, which are generally homomallous, often set in two ranks.

The leaves are almost exactly as in *C. dilatata*, but the margin is quite plane, while there it is often very slightly reflexed close to the base. I do not find the alar cells empty and thin-walled, as Brotherus describes them; in the type specimen, leg. Archer, in herb. Mitt., they are opaque. The perichaetial leaves are denticulate at margin, but less strongly so than in *C. confusa*.

In addition to these vegetative characters, *C. tasmanica* has markedly different fruiting characters from all the preceding species; the capsules are larger, wider, turgid, and the peristome is much more robust and regular, with firm, fully developed outer teeth, which are thicker in texture, and with strong lamellae, internally markedly prominent.

I have examined Colenso's *C. novae-zealandiae* (Col. No. 4217 in Herb. Kew.). I can find no differences to separate it from *C. tasmanica*, and indeed the description scarcely suggests any specific difference, except perhaps that the nerve is said to extend to the apex; but in Colenso's specimen that is not the case; the nerve ceases just below the tip as in *C. tasmanica*.

C. tasmanica occurs in both Islands, and also in Tasmania.

LEUCODONTACEAE.

LEUCODON Brid.

None of the species placed under Leucodon in the Handbook, p. 457, are now referred to that genus.

L. Lagurus Hook. = Lepyrodon.
L. implexus Kunze = Lepyrodon.
L. nitidus H. f. & W. = Dichelodontium.

Glyptothecium Hampe. This genus, previously placed in the Leucodontaceae, is now referred to Ptychomniaceae.

CYRTOPODACEAE.

This family is established by Fleischer for certain plants previously included under Spiridentaceae, and distributed amongst three genera, Bescherellea, Cyrtopus, and a new genus, Cyrtopodendron Fleisch, including one species, *C. Vieillardii* (C.M.) from New Caledonia.

Bescherellea differs from Cyrtopus principally in the absence of endostome, while in Cyrtopus the peristome is double.

CYRTOPUS (Brid.) Hook. f. Handb. N.Z. Fl., p. 461 (1867).

Cyrtopus setosus (Hedw.) Hook. f., op. et loc. cit.

Syn. *Anoectangium setosum* Hedw. sp. M., p. 43 (1801). *Cladomnion setosum* H. f. & W., Fl. N.Z. ii, 100 (1855).

This striking plant extends throughout the Islands from the extreme north to Stewart Island. It varies considerably in the degree of robustness of stems and branches, and also in the position of the leaves when dry, but is scarcely likely to be mistaken for any other species. *Cryptopodium bartramioides* is sometimes mistaken for it, but has much longer leaves, and darker colour, and the fruit is quite different.

This species is credited by Hooker (Handb. N.Z. Fl., loc. cit.) to S. America, Tasmania, and Hawaii. There are undoubted specimens in Hooker's herbarium from "Van Diemen's Ld., Cunningham, 42," and "Van D. Land, Gunn"; also from "Mauna Raab, Sandwich Is., Lindley."* All these are in fruit. There are no specimens from America, and its attribution to S. America is probably an error.

LEPYRODONTACEAE.

LEPYRODON Hampe in Ann. sc. nat. (5 ser.) Bot., iv, 367 (1865).

The two New Zealand species of this genus are to be found under Leucodon in the Handbook. Both vegetatively and in the fruit, however, they are widely distinct from that genus as now understood. The habit of the plants is not unlike that of Leptostomum.

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*For this locality see my note in Journ. Bot. lx, 290 (1922).

1. **Lepyrodon Lagurus** (Hook.) Mitt. in Journ. Linn. Soc., Bot., xii. 421 (1869).

Syn. *Leucodon Lagurus* Hook. Musc. Exot., t. 126; Handb. N.Z. Fl., p. 457.

This species differs from the following one at once in the smooth, not plicate leaves. It varies a good deal in degree of robustness, in the form of the leaf apex, and in the length and tenuity of the hair-point, which is sometimes stout, rigid and concolorous, at other times flexuose, sub-hyaline and distinctly piliform.

The Handbook rather curiously records it only from "Campbell's Island, (Barren)." I have it from several localities in the South I., and can hardly doubt that it is more widely distributed, as it occurs also in Tasmania and Australia. It is also widely spread in S. America. Most of my N.Z. specimens are in fruit.

2. **Lepyrodon australis** Hampe.

Syn. *Leucodon implexus* Hook. f., Handb. N.Z. Fl., p. 457 (*nec L. implexus* Kunze).

The New Zealand species appears to differ from that of Chile in having the peristome teeth papillose, whereas in *L. implexus* Kunze they are smooth. The vegetative difference suggested in the Handbook scarcely holds, since in the New Zealand plant the leaf apex varies from being gradually and finely attenuated to terminating somewhat abruptly in a rather wide, cucullate, hair-pointed tip. The hair-point in this species is generally more delicate and piliform than in the last, but shorter. The deeply plicate leaves at once distinguish it; and the seta also is shorter.

I have seen it only from the South I.

ECHINODIACEAE.

This Family was founded by Brotherus to include the single genus Echinodium, the species of which had usually been classed with Sciaromium, a genus with which, however, it has no very near affinity. The general habit and vegetative character is somewhat that of Cyrtopus, but the fruiting characters differ considerably, and are indeed almost Hypnoid. I am inclined to think it should be placed near to Hypnaceae.

ECHINODIUM Jur. in Bot. Zeit., 1866, p. 20.

(Hypnum, Group Hispida, Handb. N.Z. Fl., p. 473).

KEY.

1	Very slender and delicate; leaves small, ligulate from a slightly wider base; nerve scaberulous at back; cells 5-8 μ	1. *umbrosum*
	Robust; leaves linear-lanceolate from a wider base; nerve smooth at back; cells 8-12 μ	2
2	Leaves finely tapering, nerve longly excurrent	2. *hispidum type*
	Leaves shorter and wider in acumen, nerve percurrent only	2. *hispidum* var. *glauco-viride*

1. **Echinodium umbrosum** (Mitt.) Jaeg. Adumbr. ii, 380. (Plate X, fig. 3.)

Syn. *Leskea umbrosa* Mitt. in Journ. Linn. Soc., Bot. iv, 92 (1859). *Hypnum umbrosum* Hook. f., Handb. N.Z. Fl., p. 473. *Sciaromium umbrosum* Par. Ind., p. 1156.

This has, as Mitten suggests, somewhat the form of a delicate state of *E. hispidum;* but in structure it is widely different. The leaves in *E. hispidum* are large, 3-4 mm. long, longly subulate from a wide, sub-deltoid base, the greater part of the subula being formed of the stout, excurrent nerve. In the present plant the leaves are far more laxly arranged, only about 1 mm. long, ligulate from a slightly wider base, shortly and widely acuminate, with the nerve ceasing at the apex, or more rarely excurrent in a short, cuspidate point. The nerve, though narrower, is stout in proportion to the width of the leaf, and is highly scaberulous at back; and the cells are much smaller, 5-8μ as compared with 8-12μ; the leaf margin is not at all thickened. The stems, moreover, are but an inch or two long.

It was collected originally by Kerr, and the Kew specimen shows one or two capsules. I have a stem in my herbarium from Mitten's collection "New Zealand, Mr. Stephenson." Apart from these two gatherings (both without definite locality) it has only been collected by Mr. G. O. K. Sainsbury, in Waihua Gorge, Wairoa, on rock, fruiting nicely. The capsules are short and turgid, but not more so than occurs, occasionally, in *E. hispidum.*

2. **Echinodium hispidum** (H. f. & W.) Jaeg. Adumbr. ii, 380. (Plate X, fig. 4.)

Syn. *Hypnum hispidum* H. f. & W. in Lond. Journ. of Bot. iii, 552 (1844); Fl. N.Z. ii, 107; Handb. N.Z. Fl., p. 473. *Sciaromium hispidum* Par. Ind., p. 1155.

Very variable in size and colour; sometimes closely resembling *Cyrtopus setosus*, sometimes much more slender, occasionally with very delicate, almost flagelliform branches. The entire leaves, of course, separate it at once from Cyrtopus.

T. W. N. Beckett found it in balls or bunches growing detached from the soil in damp places in forests, where it had no doubt been scratched up by the Wood hen, "Weka." This condition has been noted with other mosses, e.g. *Leucobryum glaucum*, and *Thamnium alopecurum*, under similar conditions.

var. *glauco-viride* (Mitt.) Dixon comb. nov. (Plate X, fig. 5.)

Syn. *H. glauco-viride* Mitt. in Hook. f. Handb. N.Z. Fl., p. 473 (1867). *Echinodium glauco-viride* Jaeg. Adumbr. ii, 380.

Leaves shorter, broader above, nerve ceasing at or just below the apex.

I have examined the original specimens of this at Kew; Fiji, Milne; and Norfolk I., Milne. The Fiji plant, which is the type, with which the Norfolk I. specimen exactly agrees, has the leaves decidedly shorter than in *E. hispidum*, with broader points and the nerve lost in the apex. In all other characters they agree exactly with *E. his-*

pidum (both are sterile). The Kermadecs plant (Raoul I., McGillivray) is intermediate between these and *E. hispidum,* having the leaves shorter and wider in the acumen than in typical *E. hispidum,* but narrower than in the Fiji specimens, and with the nerve shortly but quite distinctly excurrent. The plant cannot be considered as more than a (? insular) var. of *E. hispidum,* and the New Zealand (Kermadecs) plant forms a link with the type.

PTYCHOMNIACEAE.

A small Family created by Fleischer, into which three or four genera naturally fall which have long been shifted from one taxonomic position to another without finality. The nerveless or short-nerved leaves and the plicate capsule, together with a mostly highly developed peristome, are the main characters.

KEY TO THE GENERA.

I. Cladomnieae. Leaves erect or erecto-patent, not squarrose; capsule upright.

1	Nerve short, single; terminal bunches of gemmae numerous; plant very small, branches not flattened	*Tetraphidopsis*
	Nerve O or very short and double, terminal gemmae none	 2
2	Branches flattened, leaves pale, rounded and obtuse at apex, very glossy	*Dichelodontium*
	Branches not flattened	 3
3	Leaves acute, not plicate	*Glyptothecium*
	Robust plant, leaves plicate, with obtuse, recurved apiculus	*Cladomnion*

II. Ptychomnieae. Leaves squarrose. Capsule horizontal .... *Ptychomnion*

CLADOMNIEAE.

DICHELODONTIUM H. f. & W. e Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 875 (1907).

Dichelodontium nitidum (H. f. & W.) Broth. op. et loc. cit.

> Syn. *Leucodon nitidus* H. f. & W., Fl. N.Z., ii, 99; Handb. N.Z. Fl., p. 457. *Stereodon Lyallii* Mitt. in Journ. Linn. Soc., Bot., iv, 89 (1859).

Very distinct in the pale, glossy branches, the leaves widely rounded at apex, concave, entire, with the upper cells elliptic-rhomboid; and the shortly cylindrical capsule deeply plicate when dry.

Wilson compares it with Pterogonium; but as that is understood now, it does not seem a very fortunate comparison.

The species is endemic, and occurs in both North and South Is.

Brotherus attributes the generic name and the binominal to H. f. & W., Fl. N.Z. ii, 99; but in that publication the authors only say that if the species should be generically separated they propose the name Dichelodontium for it; a remark which can scarcely constitute publication.

TETRAPHIDOPSIS Broth. & Dixon in Journ. Linn. Soc., Bot., xl, 451 (1912).

Tetraphidopsis pusilla (H. f. & W.) Dixon in Journ. Bot. li, 245 (1913).

Syn. *Meteorium pusillum* H. f. & W., Fl. N.Z. ii, 101 (1855); Handb. N.Z. Fl., p. 460. *Tetraphidopsis novae-seelandiae* Broth. & Dixon, in Journ. Linn. Soc., loc. cit. (1912).

I have described and figured this species fully in the publications cited above, and need not go into it further here. It is one of the most interesting members of the N.Z. moss-flora, as being not only a very distinct monotypic genus, but also as being endemic, and moreover at present confined to a single district (Wairarapa) in the Northern I.; it was gathered there originally by Colenso, and recently by W. Gray; and it was not until the later gatherings had been described and published that their identity with the species of H. f. & W. was recognized.*

It is rather curious that Colenso's plant was in fruit, but no reference is made to the terminal bunches of gemmae; whereas in Gray's plants the gemmae are very numerous and conspicuous, while the fruit was only found sparingly and after diligent search. It is a corticolous plant.

GLYPTOTHECIUM Hampe in Linn. xxx, 637 (1859-60).

Glyptothecium sciuroides (Hook.) Hampe, op. et loc. cit.

Syn. *Leskea sciuroides* Hook. Musc. exot., t. 175 (1818-20). *Cladomnion sciuroides* H. f. & W., Fl. N.Z., ii, 100; Handb. N.Z. Fl., p. 458. *Glyptothecium Muellerianum* Hampe in Linn., xxx, 637 (1859) (*teste* Fleischer).

A plant with rather the habit of Cryphaea, or of a slender *Cyrtopus setosus*, having the capsules usually rather numerously produced along the sides of the stem; but known at once by the longer seta (3-5mm.) and the capsule markedly plicate when dry. The leaves are rather rigidly divaricate when dry, as well as when moist. The branches tend to curl at the tips in the dry state, whence the specific name; but this is not a constant character.

It occurs in both Islands, and is probably not uncommon.

CLADOMNION H. f. & W., Fl. N.Z. ii, 99.

Cladomnion ericoides (Hook.) H. f. & W., op et loc. cit.; Handb. N.Z. Fl. p. 458.

Syn. *Leskea ericoides* Hook. Musc. exot., t. 28.

One of the finest and most distinct of the N.Z. mosses, and endemic in the Island. The robust, terete, somewhat vermicular stems, with the closely arranged, broad, plicate leaves, with obtuse apiculus strongly reflexed, and the elongate, sulcate capsule, are like no other species.

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*Since the above was written it has been found in the neighbourhood of Wairoa, Hawkes Bay, by Mr. G. O. K. Sainsbury.

Fleischer (Hedwig., lv (1914), p. 214) refers to a "*C. trichoides* (Hook.) H. f. & Wils. from New Zealand" in Herb. C. Mueller. I cannot trace this name, and have no doubt it is a *lapsus calami* for *C. ericoides.*

PTYCHOMNIEAE.

PTYCHOMNION Mitt. in Journ. Linn. Soc., Bot., xii, 536 (1869).

1. **Ptychomnion aciculare** (Brid.) Mitt. op. et loc. cit.

Syn. *Hypnum aciculare* Brid. Musc. rec. ii, Pt. 2, p. 158 (1801); Fl. N.Z. ii, 110; Handb. N.Z. Fl., p. 480. *P. cygnisetum* (C.M.) Par. Ind., p. 1060. *Hypnum cygnisetum* C.M. in Flora, lxviii, 425 (1885).

A very beautiful species often forming large, deep masses; readily known by the rigid habit, the stiffly spreading leaves, more or less rugose when dry, with longer or shorter, flexuose, coarsely toothed acumen; the wiry, blackish seta, and cylindrical, deeply plicate capsule. The leaf arrangement varies in density, but it is generally sufficiently lax to allow the blackish stem to be seen, though frequently it is quite hidden. Small forms occur, occasionally with leaves scarcely half the normal size, but structurally not distinct.

P. cygnisetum (C.M.) is separated entirely on the more robust habit and "cygneo-flexuosus" seta. The most robust forms of *P. aciculare* often have a straight seta, so that the former character can have no weight; and as many of the Chile specimens in Herb. Hook. have setae varying from quite straight to strongly arcuate on the same plant, it is quite clear that the character—and the species based on it—is valueless.

EXCLUDED SPECIES.

PTYCHOMNION DENSIFOLIUM (Brid.) Jaeg. Adumbr. ii, 617.

Syn. *Hypnum densifolium* Brid. Sp. M. ii, 204 (1812); Handb. N.Z. Fl., p. 480.

This species was described from specimens collected in Tristan d'Acunha, and is credited to New Zealand on the strength of a plant from Wellington, coll. Stephenson, in Herb. Mitten, in the Handbook, *loc. cit.* No specimen of this exists at Kew, but I have received from the New York Bot. Garden, by the kindness of Mrs. Britton, part of the original specimen ex herb. Mitten, "*Hypnum densifolium* Brid., New Zealand, Stephenson." This however proves to be only one of the small forms of *P. aciculare* mentioned above. The Tristan d'Acunha plant, of which plentiful material exists at Kew, is very similar to these small forms, and is very constant in size and habit, as well as, apparently, in structure; the leaf acumen is very markedly different from that of *P. aciculare*; in the latter it is sometimes gradually but usually abruptly narrowed to a long, rigid, more or less loriform, half-twisted acumen, coarsely and rather distantly toothed. The length of the acumen varies a good deal in different plants, and here and there a leaf may be more finely denticulate, but there is no difficulty in finding some at least of the normal form and toothing.

In the Tristan d'Acunha plant the leaves are very shortly but acutely acuminate, the acumen rarely if ever half-twisted, and the denticulation is far finer, closer and more regular, though quite well marked.

Now Stephenson's plant while here and there showing leaves rather unusually finely toothed, has the acumen far longer than in the Tristan d'Acunha species, nearly always half-twisted, and nearly always coarsely toothed; in fact the greater number of the leaves are in these respects quite normal *P. aciculare*.

The authors make a good deal of the position of the leaf as a distinctive character; in *P. aciculare* spreading and only slightly reflexed from a very shortly erect base; in *P. densifolium* strongly reflexed from a long, erect base. Stephenson's plant certainly shows this latter character in a more marked degree than in most specimens of *P. aciculare* which I have seen; but on the other hand the Tristan d'Acunha plant does not exhibit it in anything like the degree one would expect from the descriptions; in fact I must frankly admit that I was unable to detect it on the Kew specimens. However that may be, the New Zealand plant is certainly not the true *P. densifolium*. I am inclined to think that Mitten laid too much stress on this character drawn from the leaf direction, and neglected the form and toothing of the acumen, which is far more marked and very characteristic. *P. densifolium* must certainly be removed from the New Zealand list. It appears, at present at least, to be endemic in Tristan d'Acunha.

NECKERACEAE.

TRACHYLOMA Brid. Bryol. univ. ii, 277 (1827).

Trachyloma planifolium (Hedw.) Brid. op. et loc. cit.

> Syn. *Neckera planifolia* Hedw. Sp. M., p. 206, t. 48 (1801); Hook. Musc. exot. t. 23; Fl. N.Z. ii, 103; Handb. N.Z. Fl., p. 463. *Neckera Trachyloma* C.M. Syn. ii, 44. *Trachyloma Menziesii* Par. Ind., p. 1301. *Trachyloma Helmsii* C.M. in Hedwig., xxxvii, 171 (1898).

There has been an attempt to distinguish two New Zealand species, one the original plant of Hedwig, the other that of Menzies described and figured by Hooker in the Musc. exot.; which Hooker himself considered to be Hedwig's species. C. Mueller in the Synopsis has separated Menzies' plant as *Neckera Trachyloma*, but I am quite in accord with Brotherus' view that there is only one species involved. C. Mueller bases the difference partly on habit, Hedwig's plant being supposed to have the stems pinnately branched to apex, the leaves smooth, not striate, the seta shorter, the lid conical (the fruiting characters being deduced from Hedwig's figures). His *Neckera Trachyloma* has the stem unbranched for some distance in its apical region, the leaves indistinctly striate or plicate, the seta rather longer, the lid of capsule subulate.

As to the branching: stems of the same gathering, and probably from the same primary stem, show both forms together, and it is in fact a quite inconstant character.

The striation of the leaves rarely occurs, and when it does is not correlated with the other characters attributed to *N. Trachyloma*.

The seta varies from 1cm. to 2cm., but all intermediate forms occur, and there is no relation between this character and the others suggested.

The lid appears to be constantly conico-rostrate. I have seen no lids that we should term conical, though in just mature capsules they are gradually narrowed from base to tip, not suddenly contracted to a rostrate beak. It is to be noted that Hedwig does not figure the lid; but as the lids of *Neckera viticulosa* figured on the same plate of the Sp. M., which are described by Hedwig as *conical*, are precisely of the usual form in the New Zealand species under discussion, i.e. as we should term it, conico-rostrate, it is fair to suppose that Hedwig's plant of *N. planifolia* possessed a similar lid; and the chief difference proposed by C. Mueller disappears.

There is therefore no reason to consider that there are two N.Z. species. *T. Helmsii* C.M. from the description differs from *T. planifolium* in no respect, and Brotherus' suggestion that it is not specifically distinct is no doubt correct.

Trachyloma planifolium is a plant more easily recognized than described. The long, rather rigid, very complanate, somewhat glossy fronds with scariose, flattened, ovate leaves, serrulate and faintly nerved, and smooth cylindric suberect capsule, pale peristome, the teeth long, the processes filiform, nodose, white, are the main characters. In *Climacium dendroides* and *Sciadocladus Kerrii*, with something the same habit, neither branches nor leaves are complanate, and their structure is very different.

The leaves in this plant, and in other species of the same genus, have a marked tendency when old to turn whitish or silvery.

I have received from two or three localities a marked form (f. propagulifera) in which the upper part of many of the branches is entirely defoliate, but densely clothed with brown, septate gemmae,—the whole having the appearance, in miniature, of a bottle-brush. This form occurs in both Islands.

The species is frequent, and extends to Tasmania and Australia.

WEYMOUTHIA Broth. in Engl. & Prantl, Pflanzenfam., Musci., ii, 811 (1906).

The species of this genus have usually been placed in Meteorium or Pilotrichella. The genus is based to a considerable extent on microscopic peristome characters, as well as the naked, not hairy calyptra; but the New Zealand species are at once known from any of the allied plants, especially the pendulous species of Meteorieae, by the highly concave, cochleariform leaves, obtuse or nearly so. Any difficulty likely to arise, in fact, is rather curiously not with allied plants, but with certain species of Lembophyllum; the resemblance is indeed, considering that they belong to two distinct Families, rather strikingly close. I refer to these similarities under the separate species.

KEY.

Stems and branches robust, 2-3 mm. across; leaves large	1. *cochlearifolia*
Stems and branches filiform, about 1 mm. across; very soft; leaves small, about 1 mm. long	2. *mollis*

1. **Weymouthia cochlearifolia** (Schwaegr.) Dixon comb. nov.

Syn. *Hypnum cochlearifolium* Schwaegr. Suppl. 1, Pt. 2, p. 221 (1816); Fl. N.Z. ii, 111; Handb. N.Z. Fl., p. 480. *Hypnum flexile* Hook. Musc. exot., t. 110 (nec *H. flexile* Sw.). *Coelidium cochlearifolium* Jaeg. Adumbr. ii, 383. *Lembophyllum cochlearifolium* Lindb. in Act. Soc. sc. fenn. 1872, p. 277. *Meteorium molle* var. *majus* Bastow, Tasmanian Mosses, p. 81, in Papers & Proc. R. Soc. Tasmania, for 1886 (1887).

var. BILLARDIERI (Hampe) Dixon comb. nov.

Syn. *Neckera Billardieri* Hampe in Linn. xxx. 637 (1859-60). *Pilotrichella Billardieri* Jaeg. Adumbr. ii, 163. *Hypnum cochlearifolium* var. *β* H. f. & W., Fl. N.Z. ii, 110; Handb. N.Z. Fl., p. 480. *Weymouthia Billardieri* Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 812.

In all my study of the New Zealand mosses, no two plants I think have given me such perplexity as the two placed by Brotherus (a) in Neckeraceae, as *Weymouthia Billardieri*, and (b) in Lembophyllaceae as *Lembophyllum cochlearifolium*. For the plants to be not only generically distinct but to be allotted to two quite different Families, argued some very wide differences; but the few authors who deal with these plants seem to make no comparisons and draw no distinctions between them. Herbarium specimens give little help. It appeared that the plant known as *Weymouthia Billardieri* had more pendulous and flexuose stems, the *Lembophyllum cochlearifolium* a more rigid, more branched habit, with straighter branches; but the leaf characters appeared to show no difference whatever. A further study of more specimens showed that the vegetative characters are very ill defined, and all intergrading forms occurred; so that I find a note in my herbarium that the two plants are quite indistinguishable vegetatively, though with marked fruiting characters. On attempting, however, to draw up a definition of these fruiting characters, I found them by no means so well defined as at first appeared. From the descriptions and figures (e.g. Hook. Musc. exot., t. 110) *L. cochlearifolium* possessed a rather elongate, oblong capsule, on a longish, straight seta arcuate above, of about ¾in.; while *W. Billiardieri* had a very short, curved seta, and very turgid, almost globose capsule. These two forms are in fact represented by numerous specimens in my herbarium. But careful microscopic examination of the two, which I expected to reveal further structural differences, so far from doing so revealed a very striking similarity even in small details. The perichaetia are identical in the two. The spores, which are rather unusually large for this class of plant, are identical in both, measuring from 21 μ to 30 μ, exactly similar in form, colour, and the scaberulous surface. The peristome is identical to the smallest detail;

the 1-2 cilia between the processes are short, nodose, widened at base, and the dimensions and sculpturing of the peristome in the two are exactly similar. The exothecium structure is rather distinct in the form of the cells, but is similar in the two except that in the turgid capsule of *W. Billiardieri* they are almost isodiametrical, while in the elongate capsule of *L. cochlearifolium* they are decidedly elongate, though of quite the same character, rather widely hexagonal, arranged in fairly regular longitudinal rows, and incrassate.

Closer investigation of these apparent differences in the fruiting characters, moreover, showed that they were far from constant. The lid of *W. Billardieri* is stated to be acuminate, that of *L. cochlearifolium* obtuse, but I have both acute and obtuse lids on the same stem. The length of the seta undergoes a very unusual variation on the same plant; thus in a single gathering from Otago, coll. D. Petrie, I find setae ranging from .5cm. to 1.6cm. in length, with all intermediate stages; on a single stem there are setae of 1.4, 1.3 and two of .5cm. These latter are just the ordinary length of *W. Billardieri*, and absolutely the only difference in this case from that plant is the slightly longer and narrower capsule. In a further specimen of D. Petrie's from Leith Valley, Dunedin, the seta is of the short form characteristic of *W. Billardieri*, while the capsule is intermediate in form.

There can, to sum up, be no doubt that the two plants are not only congeneric but conspecific, and the plant with turgid capsules and usually more flexuose stems is at the most a varietal form.

It would appear that the view taken in the Handbook of the N.Z. Fl. is the same as that at which I have arrived; although it was not till I had formed the opinion that I recognized this fact. In that work the plant described as the type-form of *Hyp. cochlearifolium* Schwaegr. is the long-setaed, non-pendulous form described and figured by Hooker in the Musci exotici. This is followed by the description of "var. *β*. Stems more or less pendulous; branches shorter; fruit-stalk very short, stout; capsule more rounded; operculum acuminate." There is nothing to indicate the authorship of the variety, nor whether the recorded distribution of the species applies to the type or the var. Whichever is the case, there can be little doubt that the var. *Billardieri* is intended by the var. *β* though I have not seen it cited in any synonymy of *W. Billardieri*.

W. cochlearifolia occasionally but rarely shows a very highly flagelliferous state.

Fleischer has distributed a "n. var. *luxurians*" from Taranaki (M. frond. Arch. Ind. et Polynes., No. 427); but it does not appear to me to be more robust than the ordinary forms. His "forma typica" (id., No. 470) is perhaps rather more slender than usual.

I have received from Tasmania a specimen named "*Meteorium molle* var. *majus* Bastow" which I believe to be an authentic specimen of Bastow's plant; if so, and Bastow's description quite lends itself to this conclusion, it is only *W. cochlearifolia*.

2. **Weymouthia mollis** (Hedw.) Broth. op. et loc. cit.

Syn. *Leskea mollis* Hedw. Sp. Musc., p. 234 (1801). *Neckera mollis* C.M. Syn. ii, 131. *Stereodon mollis* Mitt. in Journ.

Linn. Soc., Bot. iv, 88. *Pilotrichella mollis* Jaeg. Adumbr. ii, 164. *Meteorium molle* H. f. & W., Fl. N.Z. ii, 100; Handb. N.Z. Fl., p. 459. *Pilotrichella pallidicaulis* C.M. in Hedwig. xli, 129 (1902) (*fide* Brotherus). *Pilotrichella Weymouthii* C.M. op. cit., p. 130 (*fide* Brotherus). *Neckera Cumingii* C.M. Syn. ii, 132 (1850).

Recognized at once by its long, pendulous habit, and very soft texture; far more slender than any forms of the preceding, and with narrower leaves. The soft, obtuse, cochleariform leaves distinguish it easily from any of the species of Papillaria.

The fruit is similar to that of the var. *Billardieri* of the preceding, but smaller, and with much more elongate perichaetia, reaching beyond the middle of the seta.

The two plants cited above from Hedwigia are but ordinary forms of this species. There is nothing whatever in the description of *P. pallidicaulis* to suggest any difference from *W. mollis*. The S. American *Neckera Cumingii* is quite identical also with the N.Z. plant.

While presenting no difficulty with regard to *W. cochlearifolia*, it is quite different as concerns *Lembophyllum clandestinum* (H. f. & W.), as *W. mollis* sometimes occurs in shorter, denser, bright green, more rigid forms that (in absence of fruit) are very difficult to distinguish from that species, which bears a very parallel relationship in both habit and fruiting characters to that of *W. cochlearifolia* in comparison with the var. *Billardieri;* so much so that it seems rather inconsistent to keep the present two plants widely separated while uniting the two former. In the present case, however, the difference of habit is greater, and intermediate forms rare; while I have seen no intergrading in the fruiting characters, and the perichaetia are markedly different (that of *L. clandestinum* being short, and with sub-obtuse inner leaves, as in *W. cochlearifolia*). I have also noted a slight difference in the alar cells of the leaves which may be constant, those of *L. clandestinum* being elongate with markedly sinuose walls, while in *W. mollis* they are oval or rounded, nearly isodiametrical, and with the walls not or scarcely sinuose. *L. clandestinum* is also said to be autoicous, while the present plant is dioicous. It may perhaps be a question whether it would not be better to place the genus Weymouthia next to Lembophyllum instead of in its present position.

W. mollis, like the last species, is a frequent moss in New Zealand.

PAPILLARIA C.M. in Oefv. af K. Sv. Vet.-Akad. Foerh., 1876, No. 4, p. 34.

This species now placed in this genus, mostly pendulous, arboreal mosses, are to be found under Meteorium in the Fl. N.Z., and Handbook.

Brotherus recognizes five N.Z. species, *P. filipendula*, *P. kermadecensis*, *P. flexicaulis*, *P. crocea*, and *P. flavo-limbata*, apart from *P. amblyacis*, an Australian plant which certainly occurs in New Zealand.

The species of this group of Papillaria are difficult to arrange and distinguish; the fruit is extremely rare. Among the very numerous specimens I have in my Herbarium of the above plants I possess only a single capsule (of *P. amblyacis*) and that on an Australian specimen. The characters usually relied on are the outline of the leaf, the presence or otherwise of a pale border, the denticulation of the auricles, and the length of the nerve; but for the most part I find these characters ill-defined and elusive, and to some extent misleading. I am inclined to think that a more valuable character is to be drawn from the position and appearance of the leaves when dry, especially the leaves on the more robust branches—the stem leaves and the leaves of the more slender, flagelliform branches are apt to be less characteristic;—I have attempted to draw up a Key relying mostly on this character, which I believe will be helpful, though I cannot hope that it will solve all the difficulties.

(a) The leaves when dry may be convex and smooth at back, not furrowed nor striate nor with the nerve prominent. In this case they may be wide, short, very short-pointed, and closely imbricated, or they may be more or less longly tapering, and while imbricated, less closely so. The apex is more or less distinctly recurved. The species with this type of foliation are *P. filipendula*, *P. flexicaulis*, and *P. amblyacis*.

(b) The leaves may be erect and more or less rigidly appressed, rigid, not flexuose nor undulate, with the nerve stout and prominent at back, and a rather clearly marked furrow on each side of it, so that the leaves are longitudinally plicate. Apex not recurved. *P. crocea*.

(c) The leaves may be erect and more or less rigidly appressed, but less closely than in (b), with the margins more or less waved and undulate, so that the leaves are not convex at back. Some forms approach *P. crocea*, but as a rule the leaves in (c) are much less rigid and straight, less closely appressed to the stem, so as to leave marked interstices between them; and usually the acumen is longer and more flexuose. *P. flavo-limbata*.

(d) The leaves when dry are scarcely altered in position, being straight, and rigidly divaricate, not appressed, and not undulate or flexuose; they are less crowded than in the previous species, and this with the slender habit renders the species quite distinct. *P. nitidiuscula*.

KEY TO SPECIES UNDER (a).

Extremely slender, subfiliform; leaves very small, narrow, longly and finely acuminate, often subpiliferous	2. *filipendula*
Moderately slender; shorter and much more rigid; leaves wider, gradually tapering to a short, acute, but not finely acuminate nor piliferous point	1. *flexicaulis*
Usually robust; branch leaves very closely imbricated (so that the branches are terete), very wide and short, abruptly ending in a very short, pale cusp or mucro	3. *amblyacis*

1. Papillaria flexicaulis (Tayl.) Jaeg. Adumbr. ii. 175.

Syn. *Leskea flexicaulis* Tayl. Ms. *Meteorium flexicaule* H. f. & W., Fl. N.Z. ii, 101 (1855); Handb. N.Z. Fl., p. 460.

The description of this in the Handbook is misleading, as it includes *P. filipendula*. This is, indeed, very closely allied, and I have found the separating characters assigned to the two mostly quite unreliable. The breadth of the auricles and their denticulation give no satisfactory results. Brotherus classes *P. filipendula* with species having no pale border to the leaves, and *P. flexicaulis* with those having a pale border, but I have specimens exactly agreeing with the original of *P. flexicaulis* showing no difference whatever in this respect from *P. filipendula*. The distinction must I think be based principally on habit and partly on leaf form. I have examined the type of *Leskea flexicaulis* Tayl. in Herb. Hook.; the description in the Fl. N.Z. applies admirably; it is not a very elongate or delicate plant; frequently yellowish in colour, but sometimes—as in *P. filipendula* usually—dull olive green, with the leaves (of the type (a) described in the Key) broader and more shortly pointed than in *P. filipendula*, in fact somewhat intermediate between that and *P. amblyacis*. The leaves gradually tapering and rigidly divergent at the points distinguish both species from *P. amblyacis*.

The upper cells in *P. flexicaulis* are almost identical with those of *P. crocea*, but the pale border is less marked.

2. **Papillaria filipendula** (H. f. & W.) Jaeg. Adumbr. ii, 175.

Syn. *Meteorium Filipendula* H. f. & W., Fl. Tasm. ii, 203 (1860).

I have pointed out the distinctive characters between this and *P. flexicaulis* above. It is the most slender and delicate of the New Zealand species, though attenuated forms of *P. crocea* may approach it very closely in this respect.

Neither *P. flexicaulis* nor *P. filipendula*, judging from the collections I have received, is so common in New Zealand as the remaining species.

P. filipendula is found also in Java.

3. **Papillaria amblyacis** (C.M.) Jaeg. Adumbr. ii, 171.

Syn. *Neckera amblyacis* C.M. in Linn. xxxvi, 521 (1869-70).

This although somewhat variable in size and leaf disposition is nearly always recognizable at once by the terete, julaceous branches when dry, the leaves being very broad, smooth and convex at back, very closely and densely imbricated, with a very short and abrupt, pale, recurved mucro or cuspidate point. The plant is frequently yellow or orange, though less so than in the following species. It is often robust, with stems which may be a foot in length. The cells are similar to those of *P. crocea*. The nerve is longer than in any of the species, reaching nearly to the apex; and is highly pellucid.

It appears to be common.

4. **Papillaria crocea** (Hampe) Jaeg. Adumbr. ii, 171.

Syn. *Pilotrichum croceum* Hampe in Linn. xxv, 715 (1852). *Meteorium cuspidiferum* Tayl. Ms. (as *Neckera*) H. f. & W., Fl. N.Z. ii, 101 (1855); Handb. N.Z. Fl., p. 459. *Papillaria cuspidifera* Jaeg. Adumbr. ii, 176. *Neckera* *kermadecensis* C.M. in Bot. Zeit. 1857, p. 779. *Papillaria kermadecensis* Jaeg. Adumbr. ii, 169. *Trachypus Hornschuchii* Mitt. in Journ. Linn. Soc., Bot., iv, 90 (1859).

The synonymy (of which I have only given a part) is very involved, and is due partly to the supposition that two species were concerned, one in the East Indies, the other in Australasia; the former generally known as *Papillaria cuspidifera*, the latter as *P. kermadecensis.* Fleischer (Musci . . von Buitenz., iii, 770) treats *P. kermadecensis* (C.M.) as "at best a sub-species of *P. cuspidifera*, distinguished by the plicate, somewhat incurved leaves, even when moist." The Indian plant seems in fact to have the leaves usually less plicate when dry, and sometimes not or scarcely so at all, while in the Australasian form they are usually very markedly so. But I have Indian specimens with the leaves quite markedly plicate, though less so than in the most pronounced forms from Australasia; while on the other hand I have Australasian plants, notably a specimen of T. W. N. Beckett's (Teremakau Bush, N.Z., No. 979) which is as free from plicae and with the leaves as loose (not appressed and incurved) as any forms from India; and intermediate forms are not infrequent. It is quite certain that if the two plants were to be kept apart as species each of them would have to be credited to both regions; and moreover a large number of specimens would have to be admitted to be equally assignable to both species.

The reason of their having been separated is partly based on geographical considerations, and partly no doubt owing to the fact that C. Mueller in describing *N. kermadecensis* makes no comparison with *P. cuspidifera*, and it therefore became assumed that it was quite distinct.

C. Mueller in Linn. xxxv, 615 (Beitr. zur ostaustralischen Moosflor.), however, gives *Met. cuspidiferum* Tayl. in Fl. N.Z. ii, 101 as a synonym of his *N. kermadecensis*, so that at that date he had recognized the affinity of the two, though this did not, probably, involve the conclusion that the Indian and Australasian plants were identical.

The form referred to above as having the leaves erect but not appressed, and not plicate when dry, is likely to give rise to difficulty when tested by the Key given above; it will however be distinguished from the species under (a) by the leaves being scarcely convex at back, and not closely imbricated, and from *P. flavo-limbata* by their not being undulate or flexuose, and much less densely arranged.

The cells in the upper part of the leaf in *P. crocea* are short (2 × 1 and 3 × 1), irregularly rhomboid, and are rendered exceedingly opaque and obscure by dense, low papillae, so that the walls appear very pellucid by comparison. There is a pale border of 2-3 rows of cells round most of the leaf.

Pilotrichum croceum Hampe seems to have passed almost unnoticed by authors; principally perhaps because C. Mueller (Linn. xxxv, 622) refers to it as synonymous with *Met. flexicaule* Fl. N.Z. This however is not the case. I have examined the type in herb. Hampe; it is quite distinct from *P. flexicaulis*, but is entirely identical with *Met. cuspidiferum* and *Neckera kermadecensis*, and must have priority over both these names. The date given by Paris (Index, Ed. ii, p. 353) for Hampe's name, viz. 1862, it is rather vital to note, is an error; it should be 1852.

This species, too, is common in New Zealand.

5. **Papillaria flavo-limbata** (C. M. & Hampe) Jaeg. Adumbr. ii, 171.

Syn. *Neckera flavo-limbata* C.M. & Hampe in Linn. xxvi, 502 (1853). *Trachypus cerinus* Mitt. in Journ. Linn. Soc., Bot., iv, 91 (1859). *Meteorium cerinum* H. f. & W., Fl. Tasm., ii, 203. *Meteorium cuspidiferum* var. *cerinum* Hook. f., Handb. N.Z. Fl., p. 459.

This is the most robust of the New Zealand species, though at times it may be quite slender, and is frequently provided with abundant, long, filiform, flagellate branches; it is often of a rich orange yellow. That the size or habit is not more than a question of temporary or local conditions is evident from a Tasmanian specimen I possess having the branches on one side of the tuft extremely robust and turgid, and gradually passing off—on the other side—into an extremely attenuated form like *P. filipendula*.

The turgidity of the branches is caused by the exceedingly close phyllotaxy, while the leaves, though extremely numerous, are not by any means closely imbricated, but rather rigidly spaced and set apart from one another. The nerve is prominent at the back as in *P. crocea*, and occasionally slender forms are not easy to separate from that, but nearly always the habit is very distinct, the leaves being decidedly undulate and flexuose, with the margins often recurved and waved, so that the back of the leaf is not at all markedly convex. The pale (or yellowish) border to the leaf is also much more strongly marked than in the other species. The upper cells are of much the same character, but are more elongate, and while not more opaque are still more obscure and ill defined, owing to the papillae.

Mr. G. O. K. Sainsbury has pointed out to me a remarkable feature of a plant gathered by him in Wairoa Co., Hawkes Bay, which I find on examination to be fairly constant throughout the species, and to constitute in fact a specific character. Most specimens show here and there, principally at the apices of the less robust branches, a number of leaves ending in piliferous, flexuose, more or less hyaline hair-points, as in a good many allied species. The extreme apex of most of these hair-points, however, in *P. flavo-limbata*, is curiously branched or forked, ending in two (or three) very short branches, which are usually more or less at right-angles to the shaft, or sometimes slightly recurved, reminding one somewhat of the barbed apices of the leaves of *Antitrichia curtipendula*. (Plate X, fig. 7.)

It is confined to Australasia, and is common in both Islands.

6. **Papillaria nitidiuscula** Broth. MS. in sched., sp. nov. (Plate X, fig. 6.)

Gracilis, soedide vel flavo-viridis, subnitens. Rami secondarii dimorphi, alteri serotini corticoli perbreves, robustiusculi, densifolii; alteri (plurimi) penduli, usque ad 20 cm. longi, pergraciles, flexuosi, laxiuscule pinnatim ramulosi, ramulis circa 1 cm. longis, saepe attenuatis. Folia ramea atque ramulina subsimilia, e basi latissime valde auriculata subtriangularia, leniter plicata, in acumen angustum, foliis superioribus saepe filiforme, substrictum, erecto-patens, siccum madidumque rigide divaricatum producta. Costa plusminusve notata, dimidiam partem folii plerumque attingens. Folii margines apud auriculas denticulati, superne minute erosi, haud denticulati. Cellulae superiores sat distinctae, nec valde obscurae nec opacae, anguste rhomboideae vel lineari-rhomboideae, parietibus firmis nec valde incrassatis, lumine dorso saepe papillis 1-3 altiusculis praedito; marginales haud pallidiores; basilares sensim breviores, paullo latiores, ad basim auricularum plures latiusculi, breviores, parietibus valde incrassatis, porosis, sinuosis. Fructus ignotus.

Hab.: On tree in scrub, Ballina, N.S.W., July, 1900; W. W. Watts (Type). Trees, Skinner's Creek, Richmond R., Ballina, N.S.W., May, 1897, W. W. Watts, Mosses of N.S. Wales, No. 1194, as *Papillaria intricata* Mitt. North Auckland, N.Z., H. B. Matthews, 1925 (No. 251).

The New Zealand specimen was sent me by Mr. G. O. K. Sainsbury, among mosses collected by Mr. Matthews in the north of Auckland, but without closer localization. I recognized it as something different from the known N.Z. species, and was able to identify it with the Ballina plant, collected in 1900, to which Brotherus had given the MS. name. I also recognized the same species in the earlier Ballina specimen, distributed as *P. intricata* Mitt., det. Brotherus. The Samoan *P. intricata*, however, has the leaves half-twisted, both moist and dry, and has quite different areolation.

The type plant differs from the two others in having a preponderance of the very short, robust, densely foliate, corticolous branches, which appear to be the first formed, the long, pendulous, slender ones appearing later. The Ballina 1194 has a very few of these; the N.Z. specimen does not show them, due probably to the whole plant not having been collected.*

The species, although at first sight not unlike very slender forms of *P. crocea*, and *P. flavo-limbata*, is really very distinct, especially in the areolation. In all the others the upper cells are highly opaque with dense, low papillae; in the present plant, though slightly obscure and ill-defined, this is due to the cell walls being of much the same colour and translucency as the lumen, not to the papillae, which are of quite a different nature, one or two, rarely three, on the dorsal face of the lumen of many of the cells, so that the back of the leaf, seen in profile, is distantly but quite distinctly muricate. The basal cells are not greatly altered in character, but are rather more obscure and darker than the upper ones, instead of being, as in all the other species, paler. The position of the leaves, very difficult to describe, is highly characteristic; they are much less closely set than in the other species, and when dry, as well as in the moist state the broadly auricled base stands away from the stem or branch and is then abruptly contracted to the long, narrow, straight lamina and acumen, suberect and spreading but not appressed, so as to give a bristly appearance to the branch under the lens. In the more slender branches the leaf acumen becomes almost setaceous.

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* Specimens sent later from the same locality show these branches well.

Meteorium Doz. & Molk., Musc. Arch. Ind. ined., p. 157, emend. Broth.

Meteorium nitens H. f. & W., Fl. N.Z. ii, 101 (1855): Handb. N.Z. Fl., p. 460. (Plate X, fig. 8.)

Syn. *Pilotrichella nitens* Jaeg. Adumbr. ii, 772.

This rare plant so far as I am aware is known only from a couple of stems in Wilson's herbarium at the Brit. Museum, labelled "N. Zeald., Sinclair. 1850." The plant does not belong to Pilotrichella as now understood; and while its position is not quite certain and perhaps cannot be until fruit is found, it appears to be nearer to some species of Meteorium in its limited sense than to any other genus, and should, I think, provisionally at least, be retained there. The leaves are less concave and the branches less turgid than is usual in the genus as defined by Fleischer; and the cells, though usually unipapillate have occasionally two or even three papillae on the lumen. It is probable that it would come under the genus Chrysocladium Fleisch., under which are segregated several of the species of Meteorium (as understood by Brotherus) to which the New Zealand plant has perhaps the closest affinity. Fruit however is needed before the true position can be certainly ascertained.

The stems are 3-4 inches long, evidently creeping or pendulous, with very densely arranged, very equal branches, about 5mm. long, not spreading but suberect and almost appressed to the stem, so that the frond is very narrow; the branches are tapering, slightly curved when dry; very densely foliate, but not turgid or terete as in most species of Meteorium. The branch leaves are ovate-lanceolate, rather quickly narrowed to a short, fine, usually half-twisted, cuspidate, very finely denticulate point. They are lightly plicate when moist, more strongly but irregularly so when dry; the margin is slightly undulate and here and there narrowly recurved; the base is slightly but not widely auriculate, the small, not strongly marked auricles being denticulate at margin. The leaves are imbricated all round the branches, and are erect, and rather closely imbricated, in no way complanate, spreading nor reflexed. The nerve reaches about half-way or more, and is thin, but quite distinct. The upper cells are extremely small and narrow, linear, not opaque nor obscure, mostly with a single papilla (more rarely 2 or 3) on the lumen; the papillae though extremely minute are quite well marked, so that the leaf is distinctly though very finely muriculate at back. The alar cells are short, isodiametrical, obscure, forming quite well marked, but not very clearly defined auricles. No flowers or fruit have been found.

The nearest species are perhaps *M. pinnatum* Broth. & Par. and *M. kiusiuense* Broth. & Par. from Japan and Formosa.

It is perhaps worth while mentioning that *M. Baileyi* (Broth.) Broth. from Queensland, while quite different in habit and leaf form is the nearest species in geographical distribution—in fact the only other Australasian species of the genus; and it also has the cells occasionally at least 2-3-papillate, as in the present species.

M. nitens was gathered in the North I., according to the Handbook N.Z. Fl. No nearer locality is specified.

EXCLUDED SPECIES.

Meteorium molle = *Weymouthia mollis.*
M. cuspidiferum = *Papillaria crocea.*
M. flexicaule = *Papillaria flexicaulis.*
M. pusillum = *Tetraphidopsis pusilla.*

ORTHORRHYNCHIUM Reichdt. in Verh. zool. bot. Ges. Wien, 1868, p. 115.

Syn. *Phyllogonium* Brid. Bry. univ. ii, p. 671 (1827) p.p.

The mosses of the sub-family Phyllogoniae of Neckeraceae form a very distinct group, formerly all placed under Phyllogonium Brid., characterized by the exceedingly dense, distichous, equitant, boat-shaped leaves usually possessing a very brilliant sheen, and so regularly and closely imbricate that a stem or branch may be easily taken for a single minute fern-frond or leaf; while the fruiting characters are equally marked.

Reichhardt separated the New Zealand form from Phyllogonium as Orthorrhynchium gen. nov., on grounds which (in addition to geographical distribution) would if constant certainly justify their generic segregation. Unfortunately several of the characters on which he founded it are scarcely reliable, while *P. cylindricum* Lindb., which Brotherus places under Orthorrhynchium, forms a rather uncomfortable link between the two genera both geographically and taxonomically.

Orthorrhynchium elegans (H. f. & W.) Reichdt., op. et loc. cit.

Syn. *Phyllogonium elegans* H. f. & W. in Lond. Journ. Bot. iii, 548 (1844); Fl. N.Z. ii, 102; Handb. N.Z. Fl., p. 462.

This very pretty little moss is found in both Islands, and is generally considered an endemic plant; but it is more probable that it is a species with wide distribution, and that most of the allied, geographical species are identical with it, or at most very slightly different geographical races. In this case it will have a wide distribution in Australasia and Oceania, extending even to Ceylon (*O. Nietneri* C.M.). The fruit is produced at the back of the frond, on a very short seta, so as to be easily concealed among the fronds; the calyptra is densely hairy.

The apex of the frond or branch is sometimes broad and subtruncate, at others narrowed and obtusely rounded; in the latter case the whole branch has the appearance of a microscopic Harts-tongue fern.

The only New Zealand moss at all likely to be confused with it is *Catagonium politum* (Hook. f. & W.), which apart from the fruit may at times very closely resemble it. That species, however, is nearly always laxer and more elongate, the leaves not quite so closely and densely equitant, and with a distinct recurved mucro, which is wanting in the present plant. The fruit of the Catagonium is longly exserted and quite different, but both species are most commonly found sterile.

LEPTODON Mohr, Observ., p. 27 (1803).

Leptodon Smithii (Dicks.) Mohr, op. et loc. cit.; Fl. N.Z. ii. 99; Handb. N.Z. Fl., p. 458.

Syn. *Hypnum Smithii* Dicks. Pl. crypt. Fasc. ii, p. 10 (1791).
Leptodon novae-seelandiae C.M. in Hedwig. xli, 131 (1902) *fide* Brotherus.

This well known plant is usually recognizable at once by its small, rounded leaves with punctiform cells and short single nerve, and by its remarkable circinate incurving of the densely pinnate branches when dry, though this character is very occasionally scarcely marked. It varies considerably in size; *Leptodon novae-seelandiae* C.M. is one of the very small forms, but we have similar ones in Europe. Minute-leaved flagelliform branches are often present. The fruit appears to be rather rarely produced, as is the case in some other parts of its distribution; when present it is often almost concealed among the branches, owing to the very short seta.

The geographical distribution is very wide; it is found in many of the warmer temperate regions of Europe, Africa and S. America, but is rather curiously absent from Asia (except the Caucasus) and North America.

Alsia Knightii Lindb. n. sp. MS. in herb. "New Zealand, leg. Ch. Knight," belongs here.

NECKERA Hedw. Fund. ii, 93 (1782).

KEY.

1	Leaves deeply and regularly transversely undulate, more or less acutely acuminate	1. *hymenodonta*
	Leaves not undulate, very obtuse	2
2	Leaves narrowed above to a very obtuse, widely rounded apex, capsule exserted	2. *laevigata*
	Leaves more or less truncate with a short, usually obtuse apiculus; capsule immersed	3. *Brownii*

1. **Neckera hymenodonta** C.M. in Bot. Zeit. 1851, p. 561.

Syn. *Neckera pennata* H. f. & W., Fl. N.Z. ii, 103; et Handb. N.Z. Fl., p. 463 (*nec* Hedw.).

Very closely allied to the European and N. American *N. pennata*, but differing in the peristome characters, the Australasian plant having the processes of the inner peristome better developed, and half the length of the outer teeth. The strongly undulate, pointed leaves at once separate it from the two following species.

It is a frequent moss on trees.

2. **Neckera laevigata** H. f. & W., Fl. N.Z., ii, 103; Handb. N.Z. Fl., p. 463. (Plate X, fig. 9.)

Readily known by its smooth, not undulate, often decurved-falcate leaves, and its quite exserted capsule. A very slender, elongate form occurs, but apparently is rare. I have it from an unlocalized habitat in the North I., from Brown's herbarium. The peristome and general structural characters show no departure from *N. laevigata*. I know of no other record of the species from the North I.

3. **Neckera Brownii** Dixon sp. nov. (Plate X, fig. 10.)

A *N. laevigata* differt theca omnino fere immersa, fol. perichaetialibus internis vix attenuatis, apicibus divergentibus; foliis apice plus minusve truncatis, apiculo perbrevi lato nunc obtuso nunc bene evoluto, acuto.

Hab.: South of Kennedy's Bush on bark of trees, Christchurch, Canterbury; coll. R. Brown ter. Port Cooper, Canterbury; coll. T. G. Wright (?). South I., without further locality, unnamed in R. Brown's herbarium.

I have for some time supposed this to be a form merely of *N. laevigata*, of which it has the general habit and appearance, as well as the leaf structure. Closer examination, however, shows it to be clearly distinct. In *N. laevigata* the inner perichaetial leaves are gradually attenuated, quite erect, so that the perichaetium is tapering and narrowed above; and the capsule is quite exserted on a seta about equal to its own length. In the present species the perichaetial leaves are much more shortly and broadly pointed, and are divergent at apex, so that the perichaetium, when the fruit is mature, is in no way narrowed above, and the capsule is immersed—at any rate as far as the orifice,—the rostrate lid, or when deoperculate the peristome only, being exserted. The structure of the capsule and peristome appears to be identical with *N. laevigata*.

The leaves of *N. laevigata* are often falcate, depressed on each side of the stem; they are very concave, and widely oval, above gradually but very slightly narrowed to a rounded very obtuse apex which is entire or faintly and irregularly denticulate. In *N. Brownii* the general leaf character and structure is very much the same; but the summit is pretty constantly different, being somewhat truncate instead of being gradually narrowed, and rising, in the middle apex, to a small point or apiculus, which may be very obtuse and inconspicuous, but in some leaves at least is quite marked and prominent (cf. Plate X, fig. 10.). The upper part of the leaf is either entire or finely and fairly regularly crenulate-denticulate. This form of apex is quite a frequent one in Neckera, though it does not obtain in the other N.Z. species.

The plant which I have made the type of the species is one collected by Brown and labelled by him "Neckera new species; nerveless, and the apex more rounded; capsule immersed" accompanied by a neat little sketch "drawn by W. Halliburton." Brown had seized at least the most salient characters. I have not found any difference in the nerve from *N. laevigata*. Of two further specimens in Brown's herbarium, one was unnamed, the other labelled "*Neckera planifolia*," but there is nothing to indicate whether this was intended to be a new MS. name.

The specimen from Port Cooper was sent to me some time ago with a number of other New Zealand mosses, collected I believe by T. G. Wright; under the name of "*Neckera laevigata.*"

The distribution would seem at present to be limited to a comparatively small area in the South I.

HOMALIA Bry. eur., fasc. 44-45 (1850); Handb. N.Z. Fl., p. 483 (as Omalia).

The genus Homalia is separated from Neckera on rather narrow grounds, but the New Zealand species are easily known by their smaller size, short cells, and much denser foliation. The capsule is exserted on a long seta, but the fruit is too rarely produced for this to be of much practical value.

The Key in the Handbook appears to me of little help; the leaves in *H. pulchella* are often pale green; and the leaves in *H. auriculata* are frequently denticulate.

KEY.

1	Leaves oblong, cultriform, widely laterally spreading	1. *falcifolia*
	Leaves obovate-rotund, very densely imbricate	2
2	Slender, leaves usually under 1 mm. in length, sharply unequally denticulate	2. *pulchella*
	More robust, leaves 1-2 mm. long, entire or finely crenulate-denticulate	3. *auriculata*

1. **Homalia falcifolia** (H. f. & W.) H. f. & W., Fl. N.Z. ii, 115; Handb. N. Z. Fl. p. 483.

Syn. *Hypnum falcifolium* H. f. & W. in Lond. Journ. Bot. iii, 554 (1844).

Quite different from the other two species in the oblong, cultriform, distichous leaves, widely spreading away from the stem and with the apex recurved and broad; entire and nerveless; it is also very glossy, and much more robust than *H. pulchella.* Seta about 1 cm. long; capsule short, horizontal.

Frequent in both Islands, but commoner in the Northern.

Distrib. Tasmania. There is a single undoubted Tasmanian specimen in the Kew collection.

2. **Homalia pulchella** H. f. & W., Fl. N.Z. ii., 114 (1855); Handb. N.Z. Fl., p. 483.

Syn. *Hookeria punctata* H. f. & W. in Lond. Journ. Bot., iii, 550 (1844).

The most slender of the three species, usually growing in dense, neat, dull dark green patches; very rarely fruiting. Quite distinct from *H. falcifolia*, but by no means so easy to distinguish from small forms of *H. auriculata*, which is usually distinguishable by its size alone. The leaves in *H. auriculata* have one side of the base incurved and expanded, forming a distinct auricle; but this, though far less conspicuous, is present in *H. pulchella.* Both species have a wide, rather indistinct nerve, reaching about half-way and very similar areolation. The upper margin in the present species is finely but acutely, unequally denticulate, while that of *H. auriculata* is either entire or finely (and more evenly) crenulate-denticulate.

Probably common in both Islands.

It occurs in Norfolk Island, but it is doubtful whether the record for Tasmania be correct. There are no Tasmanian specimens in our national collections in London.

3. **Homalia auriculata** H. f. & W., Fl. N.Z. ii, 115 (1855); Handb. N.Z. Fl., p. 483.

Very much like a robust form of the last (q.v.); it has a tendency to turn an orange brown.

It has not, I believe, been found in fruit, and is only known from the North I., where it is endemic and apparently not common. Specimens so named in herb. Schimper at Kew belong to *H. pulchella*. *H. auriculata* is endemic in New Zealand. *H. pulchella* is recorded from Tasmania and Norfolk I.; and *H. falcifolia* from Tasmania.

EXCLUDED SPECIES.

H. oblongifolia = *Porotrichum oblongifolium*.

POROTRICHUM Bry. jav. ii, 69 (1863).

Brotherus has referred *Homalia oblongifolia* H. f. & W. recently to Porotrichum, and I think with reason, as the leaves resemble those of some of the species of that genus very closely, and the fruit agrees. The limits, however, of some of the genera of this alliance, Neckera—Homalia—Porotrichum—Pinnatella—Thamnium, &c., are often very difficult—perhaps impossible—to define clearly. Porotrichum is still more closely allied to Thamnium, but is principally separated by the peristome teeth, densely transversely striolate for some distance up in Thamnium, papillose in Porotrichum and not striolate, or quite at the base only.

Porotrichum oblongifolium (H. f. & W.) Broth. MS. in Herb. Kew, comb. nov.

> Syn. *Homalia oblongifolia* H. f. & W., Fl. N.Z. ii, 115 (1855); Handb. N.Z. Fl., p. 483 (as Omalia). *Hookeria punctata* var. *β* H. f. & W. in Lond. Journ. Bot. iii, 554.

The resemblance to *Homalia pulchella*, which the authors describe, is rather marked at first view, but becomes slight on closer examination. Viewed with the lens the plant in its smaller forms may look very much like *H. pulchella*, but the narrower, oblong leaves, less closely imbricate, will distinguish it; and in its better developed and normal forms the highly undulate leaves, both moist and dry, at once separate it. In form the leaves are quite different. In *Homalia pulchella* they are widely rotund and spathulate from a much narrower base; here they are oblong from a much wider base; the nerve also is very robust and reaches to near the apex; and the apiculus is much longer and very acute, and the denticulations sharper.

The form of the leaves and their undulation, which is often remarkably pronounced, will separate it also from species of Thamnium.

The branches frequently become flagelliform, with minute spathulate non-undulated leaves.

It appears to be rare, and confined to the Northern I.

"*Thamnidium opacum* Schimp. MS., *Hypnum sinuosum* Hpe. in litt., Nova Zeelandia, No. 227; Knight, 1867," in herb. Schimp. at Kew, is this species.

THAMNIUM Bry. Eur., fasc. 49-51 (1852).

The only New Zealand species included in the Handbook N.Z. Fl. is *Isothecium pandum* H. f. & W., but one or two species have been added to the list in later publications.

KEY.

1	Plants very delicate, with straggling branching; leaves distant, complanate; flagelliform branches frequent	1. *pumilum*
	Plants and leaves larger, or if small, densely branched and dendroid	2
2	Robust, rigid plant; leaves large, 2-3 mm., deeply plicate when dry; nerve reaching about ⅔ of leaf, tapering above	4. *baculiferum*
	Smaller but often elongate plants; nerve ceasing just below apex, scarcely narrowed above	3
3	Leaves usually complanate, widely elliptic or subspathulate, usually broader above the middle	2. *latifolium*
	Leaves less complanate, irregularly plicate when dry, ovate-oblong, usually broadest below the middle	3. *pandum*

1. **Thamnium pumilum** (H. f. & W.) Par. Ind. p. 1272.

> Syn. *Isothecium pumilum* H. f. & W., Fl. Tasm. ii, 206 (1858). *Neckera rivalis* Mitt. in Journ. Linn. Soc., Bot. iv, 87 (1859).

This species was originally described from Tasmania, and has been found in Australia. It has not been recorded from New Zealand, but I have found a stem, mixed up with Bartramia, Rhaphidostegium, &c., in R. Brown's herbarium, which undoubtedly belongs here. The gathering was unlocalized, and may be assumed to have been in the South I., as Brown was in the habit of indicating all his North I. collections. It is a much more delicate species than any of the others, with slender, trailing stems, and small, distant, complanate leaves, narrower than in *T. latifolium*, more acuminate than in *T. pandum*, and differing from both in the nerve, which is more slender and distinctly tapering above, where it is usually rapidly narrowed and frequently forked; and generally ceasing at a greater distance below the apex. In general form and structure the leaves are otherwise much like those of the most slender forms of *T. latifolium*.

Fleischer (Musei . . . . von Buitenz. iii, 933) cites *Neckera rivalis* Mitt. in the synonymy *T. pumilum* with a query; overlooking the fact that Mitten himself cites *Isothecium pumilum* H. f. & W. as a synonym. Mitten in placing it under Neckera was obliged to give it a new specific name, the combination *Neckera pumila* being already preoccupied.

The plant on account of its slender habit and sterility may quite likely have been overlooked.

2. **Thamnium latifolium** (Bry. jav.) Par. Ind., p. 1271.

> Syn. *Porotrichum latifolium* Bry. jav. ii, 69 (1863).

Next to *T. pumilum* the smallest of the four species, and in some forms very like that, but distinguishable as noted above; it is always more slender (in the typical form) than the following two, and is more closely branched than *T. pandum.* The characters given in the Key will I think always separate it from that species.

Var. **elongatum** Dixon in Bull. Torr. Bot. Club, xlii, 106 (1915).

In addition to the locality given for this very striking var. in the work cited, I have received a specimen from Mitten's herbarium, labelled "*Isothecium pandum* H. f. & W., New Zealand, Kirk," which certainly belongs to this variety, and not to *T. pandum.* In habit it much resembles *T. pandum,* but is more flexuose, with markedly complanate leaves, which agree in structure and form with *T. latifolium.*

The cells in the present species are nearly always more regular in form than in *T. pandum,* and are also usually more regularly arranged in longitudinal rows (best seen near margin in upper part of leaf, and most easily observed when the leaf is slightly out of focus).

The distribution of *T. latifolium* is a very unusual one—Sumatra, Japan (*fide* Kindberg), New Caledonia, and New Zealand. I have it from numerous localities in the North I., but it is, I believe, not known from the South I.

Kindberg in Hedwig. xli, 219, cites *Thamnium australe* Lindb. as a synonym of *T. latifolium. T. australe,* however, is only a MS. name of Lindberg's, and should not be cited in the synonymy.

3. **Thamnium pandum** (H. f. & W.) Jaeg. Adumbr. ii, 216.

Syn. *Isothecium pandum* H. f. & W., Fl. N.Z. ii, 105 (1855);
Handb. N.Z. Fl., p. 464.

No doubt the most frequent species, and often if not usually aquatic or at least hygrophytic. It is frequently found in the spray of waterfalls. It is more rigid than the preceding plants, with elongate, sparingly branched, curved stems, the leaves not markedly complanate, rather coriaceous, oblong from a broader base with one margin widely inflexed; and usually more or less plicate when dry. I have seen no fruit of any of the other species, but *T. pandum* is not uncommonly found in fruit.

The general habit is not unlike that of *Echinodium hispidum,* but the resemblance ends there.

4. **Thamnium baculiferum** Dixon in Bull. Torr. Bot. Club, xlii, 104 (1915).

This striking species has not at present been refound. It should be searched for in the North I. The robust habit, large, complanate, rigid leaves, deeply plicate when dry, attenuated nerve, and somewhat elongate apical cells (2 × 1) will distinguish it at once, even should the straight, terete, rod-like shoots from which it is named not prove to be a constant feature.

Only known habitat, Waikopiro, Hawkes Bay; coll. Chadwick.

LEMBOPHYLLACEAE.

Camptochaete Reichdt. in Novara Exped. i, 190 (1870).

The genus Camptochaete, which may be said to have its headquarters in New Zealand, is entirely confined to Australasia and Melanesia, with the exception of *C. gracilis*, which is also found in Chile, and a single somewhat doubtful species from Ceylon. The generic characters are not too easy to define, but the species are generally easy to recognize, from the rigid, subdendroid habit, with almost woody stems, the small, ovate, concave, scariose leaves, usually obtuse or very shortly pointed, not acuminate, nerveless or nearly so, and the very narrow, small, usually sigmoid cells. The fruit also is generally produced from the upper part of the stems. The habit, however, of *C. gracilis*, and of some forms of the other species, is widely different from the typical habit, and the foliation of *C. pulvinata* is not at all that of the normal type.

One feature of the genus deserves notice, the tendency of the dense arbuscular species to produce slender, extended, more or less complanate forms, both in branching and in leaf arrangement, with laxer branches often ending in flagelliform, small-leaved prolongations. *C. deflexa* Jaeg. is one of these forms, derived from *C. arbuscula*, as was suspected by Wilson, and as is evident from the numerous intergrading forms to be found when a large series is studied. *C. ramulosa* has an exactly parallel form, and less frequently *C. angustata* (*C. spurio-deflexa* (C.M.) Broth.); and I have little doubt that *C. flagellifera* Broth. is simply a similar form of the New Guinea *C. subporotrichoides* Broth. & Geh., with which it grows, and from which it differs in no structural characters.

Key.

1	Habit usually dendroid, stems rigid, wiry; usually deep green	....	2
	Habit not dendroid, texture soft; pale; branches curved when dry, leaves denticulate at apex....	1. *gracilis*	
2	Leaves nearly all falcate or hamate at apex; branching mostly pinnate or bi-pinnate, scarcely dendroid	2. *pulvinata*	
	Leaves not falcate; branching usually dendroid or sub-dendroid	....	3
3	Leaves broadly ovate	....	4
	Leaves (of branches) narrowly ovate-lanceolate or lanceolate	5. *angustata*	
4	Leaves of primary branches cochleariform, suborbicular, widely rounded at apex with an abrupt apiculus	6. *vaga*	
	Leaves of primary branches narrower, ovate-lanceolate, more or less gradually pointed	....	5
5	Leaves rather large, nearly always somewhat wrinkled when dry, very cymbiform, with very broad, subobtuse points	3. *arbuscula*	
	Leaves much smaller, very closely and regularly imbricated, not altered when dry, narrowed (when dry) to an acute, cuspidate point, less strongly cymbiform	4. *ramulosa*	

1. **Camptochaete gracilis** (H. f. & W.) Par. Ind. p. 234.

> Syn. *Hypnum gracile* H. f. & W. in Lond. Journ. Bot., iii, 553 (1844). *Isothecium gracile* H. f. & W., Fl. N.Z. ii, 106; Handb. N.Z. Fl., p. 465. *Hypnum micro-vagum* C.M. & Beck. in Trans. N.Z. Inst. xxvi, 275 (1893). *Lembophyllum micro-vagum* Par. Ind., p. 718.

The generic position of this plant is difficult, and it is possible that it may ultimately have to find another resting place. It is very different from the other species of Camptochaete, in the non-dendroid habit, terrestrial rather than arboreal habitat, softer texture, non-glossy, non-scariose leaves, &c. The leaf structure, however, is that of the genus, except that the cells are frequently protuberant at the back of the leaf; and the fruiting characters also are normal. It is generally to be known by the pale, yellowish-brown rather than green colour, the dense tufts, irregularly branched stems, the small, imbricated leaves, which may be secund, but are not falcate; they are ovate, concave, very shortly pointed, often finely denticulate at apex.

Hypnum micro-vagum C. M. & Beck. belongs here. The papillae or mamillae at the back of the leaf are not always present, at least markedly, but when they occur they afford a useful character. The leaves vary considerably in width, and degree of obtuseness.

Hypnum (Trichosteleum) Cheesmani Geheeb in Herb. Beckett also belongs here. The papillose cells no doubt gave rise to the reference to Trichosteleum.

It occurs in both Islands, perhaps not very commonly.

2. **Camptochaete pulvinata** (H. f. & W.) Jaeg. Adumbr. ii, 213.

> Syn. *Hypnum pulvinatum* H. f. & W. in Lond. Journ. Bot., iii, 555 (1844). *Isothecium pulvinatum* H. f. & W., Fl. N.Z. ii, 105; Handb. N.Z. Fl., p. 465. ? *Camptochaete Beckettii* Broth. in Oefv. af Finsk. Vet.-Soc. Foerh. xlii, 114 (1900).

This species is somewhat intermediate in habit between the last species and the following. It may have the stems decidedly dendroid, with the tough and woody texture proper to the genus; on the other hand it may have creeping stems, of soft texture, with pinnate, bipinnate, or irregular branching, very different from the other forms. It will, however, be easily recognized by the characteristic leaves, glossy and scariose as in the succeeding species, but always more or less strongly falcate-secund, as in species of Rhaphidostegium and Stereodon, but distinguishable at once from these by the very short, wide points, which are often actually obtuse, the description in the Handbook as "long acuminate" must be taken as by comparison with the allied species of the genus only).

The seta is stout, and frequently much enlarged at the base of the capsule, so as to form a long and distinct neck.

I have not seen *C. Beckettii* Broth. but it is described as differing from *C. pulvinata* in the much smaller size, and the prostrate, bipinnate stems with short branches. I have however undoubted forms of *C. pulvinata* entirely agreeing with these characters, but connected with the type form by intermediates, and I think there is no doubt that *C. Beckettii* is referable here. A very extreme form of this kind, but—except for the short branches—of normal dimensions (Berggren, Okaeawai, 2580), is a very parallel form to the var. deflexa of *C. arbuscula*. A still more extreme form and I think more unusual is one collected by R. Brown ter., with slender attenuated branches, and more distant, less falcate leaves, some of the branches being microphyllous and flagelliform.

The distribution of *C. pulvinata* would seem to be very parallel to that of *C. gracilis*.

3. **Camptochaete arbuscula** (Hook.) Jaeg. Adumbr., ii, 213.

Syn. *Hypnum arbuscula* Hook., Musc. Exot., t. 112 (1818-1820). *Isothecium arbuscula* Brid., Bry. univ., ii, 372; Fl. N.Z., ii, 104; Handb. N.Z. Fl., p. 465.

With all its variability this may generally be recognized fairly easily by the robust habit, the large, cochleariform, widely and very shortly pointed leaves, rather less regularly arranged than in *C. ramulosa*, and frequently slightly collapsing and wrinkled when dry. The fruit appears to be rather sparingly produced; it is generally characterized by a short, stout seta, considerably less than a centimetre in length, and I have a plant with the capsules scarcely elevated above the perichaetia; but the seta may be a full centimetre long. The rigidly divergent, perichaetial leaves, with short and wide points, and the fruit produced from the branches, and not from the main stem, are normal, and may be looked upon as generic characters.

Var. **deflexa** (Wils.) Dixon comb. nov. Stems elongate, more or less pendent, not dendroid, more or less regularly pinnate or bi-pinnate, branches often flagelliform.

Syn. *Hypnum deflexum* Wils. MS., C.M. Syn. ii, 680. *Isothecium arbuscula* var. *β deflexum* Hook. f., Handb. N.Z. Fl., p. 465. *Camptochaete deflexa* Jaeg. Adumbr., ii, 213.

The various forms of this species almost defy description. It may take a form similar to the smallest specimens of *C. gracilis* with stems about 2cm. long; or it may have larger and longer stems than any New Zealand moss I know, with stems 25-30 cm. long, and regularly pinnate and bi-pinnate, plumose branching; the branches may be short and obtuse, less than 1 cm. long and 2-3 mm. wide; or they may be 4-5 cm. long, filiform and flagelliform; the branching may be as coarse as *Neckera hymenodonta*, or as delicate as a Thuidium; it may simulate closely *Weymouthia cochlearifolia* var. *Billardieri*, or equally closely *Brachythecium rutabulum*. A very remarkable form collected by R. Brown ter. on stones in water, West Coast, South I., has woody stems and branches, the latter densely fasciated, bearing leaves of all sizes, from quite minute and even microscopical ones forming slender, flagelliform branches, to the normal, large, inflated ones. Most of these forms are referable to var. *deflexa*, but it is quite impossible to delimit or to define the variety with any degree of accuracy.

It is a common species.

4. **Camptochaete ramulosa** (Mitt.) Jaeg. Adumbr. ii, 213.

Syn. *Isothecium ramulosum* Mitt. in Hook. f., Handb. N.Z. Fl., p. 465 (1867).

This species is, as stated in the Handbook, not distinguished from the last by any definite structural characters. It is, however, I think, quite a good species, and I have rarely found any difficulty in separating the two. It is generally a smaller plant with denser branching, the leaves narrower above, and quickly contracted to a short, acute point (the Handbook description of the leaves as acuminate is rather misleading); they are generally more regularly imbricated, and are not at all altered when dry. The seta is perhaps slightly longer.

C. ramulosa produces many forms, almost parallel to those of *C. arbuscula*. It appears to be equally common.

5. **Camptochaete angustata** (Mitt.) Jaeg. Adumbr., ii, 214.

Syn. *Stereodon angustatus* Mitt. in Journ. Linn. Soc., Bot., iv, 88 (1859). *Isothecium angustatum* Hook. f., Handb. N.Z. Fl., p. 465. *Isothecium obscurum* Col. in Trans. N.Z. Inst., xx, 241.

This is very similar to *C. ramulosa* in habit, but rather more delicate in all its parts; the branch leaves are much narrower, lanceolate, and taper gradually to an acute point. The fruit also when present is smaller, and the whole plant has a lighter and more delicate habit. It differs from *C. ramulosa*, in fact, in precisely the opposite direction from *C. arbuscula*. The fronds are frequently more or less complanate, and in that case the contrast between the larger, broader stem leaves and the narrower and delicate foliation of the branches is striking; but this does not by any means always occur. The alar cells are more numerous and more distinct than in the allied species.

A parallel form to the var. *deflexa* of *C. arbuscula* occurs; and forms with delicate, flagelliform branchlets are not unfrequent.

I. obscurum Col. certainly belongs here; Brotherus has written "*angustatum* Mitt." on Colenso's own specimen at Kew, and this entirely agrees with my judgment.

Camptochaete spurio-deflexa (*Hypnum spurio-deflexum* C.M. sp. nov., T. W. N. Beckett in sched.), Waimate, Canterbury, in herb. Beckett, is a very remarkable plant, with stems a foot or so long, very densely branched and rebranched with very wiry stems and branches, forming very dense Thuidioid masses. Its foliage is, however, precisely that of *C. angustata*, and it is in fact an almost entirely parallel form to that of *C. arbuscula*, coll. R. Brown ter., referred to above. Taken by itself it would seem well worth a varietal name, but in that case the derivatives of *C. arbuscula* would equally demand one, probably to be followed by the other species of the group, and it is more correct, I think, to consider them all as forms, or perhaps more accurately states, of the respective species.

I have also received a form exactly corresponding to the var. *deflexa* of *C. arbuscula* (Berggren; Lyttelton, No. 1639); but in this case forming part of a gathering the bulk of which showed the normal, dendroid habit.

C. angustata seems, like the two preceding species to be widely distributed, but unlike them is not found outside New Zealand.

6. **Camptochaete vaga** (Hornsch.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 865.

Syn. *Hypnum vagum* Hornsch. in Sieb. M. Nov. Holl., no. 23; C.M. Syn. ii, 466 (1851); Handb. N.Z. Fl., p. 481.

This distinct species may be described as having the dendroid growth of Camptochaete with the suborbicular, cochleariform leaves of Lembophyllum. The leaves are indeed very much like those of *L. clandestinum*, but instead of being rounded and obtuse they are tipped with a small, abrupt, cucullate mucro. There is frequently, but not always a trace of a nerve.

The branches are less dense than usual in the foregoing species, and are usually tapering; the seta is rather above a centimetre in length.

The presence of this Australian species in New Zealand is rather doubtful, resting upon a single specimen in Mitten's herbarium, coll. Kerr.

LEMBOPHYLLUM Lindb. in Act. Soc. Sc. Fenn. x, 277 (1872).

This genus, like the last, is difficult to define; in its fruiting characters it does not differ from Camptochaete; the distinction lies rather in the habit, which is not rigid and dendroid, but softer and with the stems more herbaceous and irregularly branched, with highly julaceous branches; the leaves are very wide, usually very obtuse, cochleariform and suborbicular; and the cells especially are much incrassate with opaque lumen, and in the upper part of the leaf are very short, with a tendency to be parenchymatous, while the alar cells form a distinct, inflated group, absent in Camptochaete. These distinctions become rather indefinite in view of the habit and texture of *C. gracilis* and the occasional tendency on the part of *L. clandestinum* to become rigid and subdendroid; while the leaves of *C. vaga* have very much the outline usual in Lembophyllum.

On the other hand, *L. clandestinum* at least is at times very difficult to separate from *Weymouthia mollis*, and I am not at all convinced that the true affinity of some of the New Zealand species is not with that genus rather than with Camptochaete.

As a rule, however, the long branches with highly julaceous, cymbiform, obtuse leaves, the minute, elliptic, incrassate, opaque cells, very short above, and the small, inflated auricles of small cells, will make them easy of recognition.

KEY.

Leaves usually pale green or yellowish, glossy, nerveless	1. *clandestinum*
Leaves usually grey-green, scarcely glossy; mostly with a short, single nerve	2. *divulsum*

1. **Lembophyllum clandestinum** (H. f. & W.) Lindb. in Act. Soc. sc. fenn. x, 277 (1872).

Syn. *Hypnum clandestinum* H. f. & W., Fl. N.Z. ii, 111 (1855); Handb. N.Z. Fl., p. 480.

This and the following are so closely allied that it is a question whether they are not forms of one and the same species. Typically the present is a slightly larger and less compact plant; the leaves are larger, very obtuse, quite nerveless, when dry decidedly glossy, of a thinner, more translucent texture, and often somewhat shrunken when dry, and wrinkled. In typical *L. divulsum* the stems are usually more densely interwoven, slightly less robust, more rigid, of a glaucous green colour, the leaves frequently slightly pointed, with a short, single nerve of variable length and distinctness; when dry they are less glossy, of a more opaque and slightly stouter texture, so that the branches may be entirely unaltered when dry. The inflorescence of *L. clandestinum* is described by Wilson as monoicous, with the ♂ flower amongst or upon the leaves of the fertile stem (phyllautoicous), that of *L. divulsum* as dioicous. Brotherus, however, ranks them both as pseudautoicous, i.e. phyllautoicous.

On the other hand, I have plants clearly of *L. divulsum* which are quite as robust as *L. clandestinum*. The leaves in *L. divulsum* show a great diversity in the nerve; I have found several plants with nerveless leaves but all the other characters of *L. divulsum*, and Wilson also found forms of *L. divulsum* with nerveless leaves.

The areolation also presents certain differences, though I am uncertain if they can be relied upon in all cases. The upper cells in *L. divulsum* are almost or quite isodiametrical ("punctiform" Wils.), while in *L. clandestinum* they are rarely so, but are shortly, minutely elliptic. The alar cells in *L. divulsum* form a less clearly delimited group, being more spread over the whole alar region and passing more gradually into the remaining cells.

L. clandestinum may also be confused with *Weymouthia mollis*, some forms of which are exceedingly difficult to separate. The longer, narrower, sigmoid cells of *W. mollis*, less incrassate and very pointed and prosenchymatous, will perhaps always separate them, and there is I believe a slight constant difference in the alar cells, those of *L. clandestinum* being somewhat elongate, with very sinuous walls, those of *W. mollis* more isodiametric and less sinuous.

Acrocladium auriculatum may easily be confused in the field with *clandestinum*, but has more acutely cuspidate branches, and the auricles composed of large, thin-walled hyaline cells.

Mr. W. Gray sent a very remarkable form of the present plant, from Mt. Bruce, Wairarapa; pendent, abundantly and densely clothed with long, delicate, minute-leaved, flagelliform branchlets.

L. clandestinum is frequent in both islands, and extends to Tasmania and Australia.

2. **Lembophyllum divulsum** (H. f. & W.) Lindb. in Act. Soc. sc. fenn., x, 277 (1872).

Syn. *Hypnum divulsum* H. f. & W., Fl. N.Z. ii, 111 (1855); Handb. N.Z. Fl., p. 481.

For the differences between this and *L. clandestinum* cf. the description of that plant. *L. divulsum* when growing in large, glaucous green patches is an exceedingly striking and handsome moss.

Berggren collected a remarkable plant on Banks Peninsula (No. 2567) of a pendent, elongate, slender habit, best perhaps described by the fact that it was named by him as "?Papillaria n. sp." The leaves have, however, exactly the form and structure of *L. divulsum*, and there is no doubt that it is a remarkable form of this species. A parallel plant of *Camptochaete vaga* in the British Museum collection ("Hyp. cochlearifolium, New Holland, Dr. Greville, 1832") shows precisely the same habit as Berggren's plant, and is connected with the ordinary form by intergrading stages.

The distribution of *L. divulsum* appears to be very similar to that of *L. clandestinum*.

ISOTHECIUM Brid. Bryol. univ. ii, 355 (1827).

None of the species in the Handbook of the N.Z. Flora are included in the genus as now understood. It will be convenient to refer them here to their various genera.

I. sulcatum	Braithwaitea
I. pandum	Thamnium
I. arbuscula, ramulosum, angustatum, pulvinatum, gracile	Camptochaete
I. Menziesii, Kerrii	Sciadocladus
I. spininervium, marginatum	Hypnodendron
I. comosum, Sieberi, comatum	Mniodendron

ENTODONTACEAE.

ENTODON C. Muell. in Bot. Zeit. 1844, p. 740.
(Cylindrothecium Bry. eur).

Entodon truncorum Mitt. in Hook. f. Handb. N.Z. Fl., p. 467.

Easily recognized by its glossy, complanate, pale green stems, resembling Plagiothecium, the acute, somewhat falcate and decurved leaves (not however finely acuminate), with two short nerves and numerous rather large quadrate alar cells, the pale seta and erect, cylindrical capsule.

E. Beckettii C.M., in litt., Peel Forest, Canterbury, T. W. N. Beckett, No. 387B, cannot I think be distinguished from *E. truncorum*.

It is confined to the South I., and has not apparently been found outside Otago and Canterbury.

FABRONIACEAE.

FABRONIA RADDI in Att. dell. Acad. de Scienze di Siena ix, 230 (1808).

One of the most distinct of moss genera, the species all being among the most delicate of the pleurocarps, without any very wide range of characters; almost constantly arboreal, nearly always autoicous and generally fruiting freely. The perichaetial bracts are characteristic, being short and wide, the inner broad above and abruptly narrowed to a fine point or hair, and the margins usually finely toothed or ciliate. The capsule is minute, ovoid, erect and symmetric, when deoperculate often urceolate, or hemispherical.

Fabronia australis Hook. Musc. Exot., t. 160 (1818-1820); Fl. N.Z. ii, 98; Handb. N.Z. Fl., p. 456.

Syn. *Fabronia octoblepharis* Knight in Trans. N.Z. Inst., viii, 312 (1875). *F. antarctica* Par. Ind., Suppl., p. 154 (1900).

The history of this species in New Zealand is remarkable. Hooker described his species from specimens collected by Menzies, St. George's Sound, Australia; and in the Handbook it is recorded as having been collected by Colenso, and by Hooker, in the Bay of Islands. Knight, in the work cited in the synonymy describes his plant as "F. octoblepharis n. s." without any reference to any other publication or plant; the only locality he gives is "on humid rocks," where no doubt "Wellington" is to be supplied, as in other cases where he described new species in the Transactions, without giving localities. It is strange that he should make no comparison with *F. australis*, which is included in the Handbook, published eight years previously, as well as in the Flora of New Zealand. Stranger still, perhaps, that he should have chosen for his specific name that of the European species—almost the type of the genus—apparently, however, without reference to, or knowledge of the northern moss.

Paris quite naturally, in view of *F. octoblepharis* Schwaegr., altered Knight's name, re-naming the moss *F. antarctica*. No specimens of Knight's appear to be present in any of our British collections, and I have been unable to examine the plant itself. Knight's description, however, is ample, and his figures are very detailed, and I do not think there can be any doubt that the species is identical with *F. australis*. Whether, however, the New Zealand plant is actually distinct from the European *F. octoblepharis* Schwaegr., is open to grave doubt. I have been unable to detect a single point of difference, and am strongly inclined to think it will have to be united with that plant, but I have not ventured to make the reduction here, especially as *F. octoblepharis* has not been recorded elsewhere in the Southern hemisphere; it is extremely probable, however, that some of the South African and South American species may turn out to be inseparable from *F. octoblepharis*, and in that case there would be no obstacle to uniting the Australasian plant also with it.

The outline of the leaf and its marginal toothing, and the strength of the nerve, vary very greatly in species of Fabronia, even as between leaves on different branches of the same stem, and this has to be taken into account in forming a judgment on their specific relation. I at one time thought that Hooker's plant might differ from Knight's in having narrower leaves, but an examination of different specimens has convinced me that there is no constancy in this; and indeed the description of the leaves in the Handbook as "ovate or ovate-lanceolate" negatives such an idea.

Hooker in the original description of *F. australis* characterizes the lid as flattish; I find it, however, distinctly apiculate, and quite as in *F. octoblepharis* Schwaegr. It is to be noted that the lid in this genus is often plano-convex when moist, but becomes conical-apiculate on drying.

It occurs in both Islands, and is probably not infrequent, but on account of its small size may have been overlooked.

HOOKERIACEAE.

This large and very interesting Family has widely varying vegetative characters, while certain of the fruiting characters are constant and striking; this is notably the case with the calyptra, which is symmetrical and mitriform, most frequently fringed at the base, and often papillose or spiculose or even ciliate above. The epidermal cells of the stem and branches (as in Fabroniaceae also) are usually lax and thin-walled. It is one of the very few Families, also, which has frequently a double nerve to the leaf, with two prolonged branches, sometimes reaching nearly to the apex. Very nearly all the genera, some thirty, are confined to the tropical or subtropical regions of the world. It is represented in New Zealand by six genera, for the most part fairly distinct; but it may be helpful to furnish a key to the main characters, the large genus Hookeria as formely understood, and as used in the "Handbook," having been split up into a number of smaller genera.

KEY.

1	Leaves narrow, acute or acuminate	2
	Leaves more or less spathulate or rounded, wide above	4
2	Nerve 0	*Sauloma*
	Nerve single, long	3
3	Nerve ceasing below apex	*Daltonia*
	Nerve reaching apex or excurrent	*Bellia*
4	Nerve 0 or double	*Eriopus*
	Nerve single, or forked at apex	5
5	Nerve undivided, leaves narrowly bordered (excluding *D. microcarpum*)	*Distichophyllum*
	Nerve often forked at apex, leaves unbordered	*Pterygophyllum*

Daltonia Hook. & Tayl., Musc. Brit., p. 80 (1818).

A large and very distinct and homogeneous genus, mostly confined to the tropics. In Journ. of Bot., 1914, p. 123, I have pointed out that the Handbook of the N.Z. Flora is in error in making *D. novae-zelandiae* Mitt. a synonym of *D. nervosa* (H. f. & W.). The latter is now placed in the following genus, Bellia, while *D. novae-zelandiae* is a true Daltonia, and quite a different plant, the affinities of which I have discussed in that article.

The cells in Daltonia are narrowly oval or elliptical.

D. novae-zelandiae Mitt. in Journ. Linn., Bot., iv, 95 (1859).

A small moss, growing on twigs, often among other mosses and hepatics, readily known by the Hookeriaceous calyptra, the narrow, acuminate leaves, narrowly bordered and deeply carinate, with characteristic areolation, and the nerve ceasing below the apex.

It appears to be rare, but occurs in both Islands.

Bellia Broth. in Engler & Prantl. Pflanzenfam., Musci, ii, 923 (1907).

This genus, consisting of one exclusively New Zealand species, was separated from Daltonia on the ground of the inflorescence, the estriate, papillose peristome teeth, with zigzag median line, and the percurrent nerve. In Daltonia the teeth are deeply furrowed along the median line, and densely striolate below.

The name is given from Bell, the well-known bryologist and collector.

Bellia nervosa (H. f. & W.) Broth., op. cit., p. 924.

> Syn. *Hookeria nervosa* H. f. & W. in Wils., Bry. brit., p. 419; Handb. N.Z. Fl., p. 496 (*nec Daltonia nervosa* H. f. & W. in Lond. Journ. Bot. ii, 420 (1842) = *Cryphaea nervosa* Bry. eur.). *Daltonia straminea* Mitt. e Beckett in Trans. N.Z. Inst., xxvi, 276 (1893). *Bellia straminea* Broth. op. et loc. cit.

Bellia straminea cannot be separated from *B. nervosa*. An examination of Beckett's description and figures of the Stewart I. *Daltonia straminea* shows that in the diagnosis he emphasizes no characters as distinguishing it from *D. nervosa* except the infloresecence; the straw-colour and the smooth seta are the only characters that suggest a distinction.

As to the infloresecence, Beckett says "The dioicous infloresecence clearly separates it from that species," i.e. *B. nervosa*. He does not mention what infloresecence he attributes to *B. nervosa*, but as a matter of fact it is dioicous also. In fact the dioicous infloresecence is given by Brotherus as one of the generic characters of Bellia, that of Daltonia being synoicous or autoicous.

There remain therefore the colour and the smooth or almost smooth seta, that of *B. nervosa* being described as rough or papillose at apex. To these characters Brotherus (Musci, loc. cit.) adds that *B. straminea* is a robust plant with suddenly narrowed leaf-points, *B. nervosa* smaller, with longer and gradually narrowed points.

The colour is at first sight distinctive, as Bell's Stewart I. moss is a bright orange brown, while *B. nervosa* is generally of a dull, pale green; but this colour is not correlated with any other characters, least of all size, because Bell's plant is generally no more robust, often much less so, than the green leaved plant from the two northern Islands. Moreover, the original gathering of *Hookeria nervosa* H. f. & W. is of a decidedly golden brown colour, though this may be partly accounted for by age. I have also a plant from Otira with quite the golden colour of the Stewart I. plant.

As to the leaf form, this varies so greatly on leaves of the same tuft that it is absolutely of no value. Beckett's description of the leaves of *B. straminea* is "linear-lanceolate, tapering gradually to a point" (it may be remarked that they are figured rather as oblong-lanceolate, by no means linear-lanceolate); and this is entirely borne out by many of Bell's specimens.

There remains only the seta. It is true that the seta in the original gathering of *B. nervosa* from Lord Auckland Is. is distinctly papillose at apex, while that of Bell's plant is smooth, or only slightly roughened at apex; but the latter is equally the case with other plants of the North and South Islands, which with smooth setae have the distinctive green, not yellow colour of the Stewart I. plant. This is notably the case with several gatherings I have from Mt. Bruce, Wairarapa, coll. W. Gray, and with Beckett's No. 930, Otira Gorge, Westland, at Kew, labelled *D. straminea*, which, with presumably smooth seta, has the foliation entirely of *B. nervosa*.

B. straminea is, in fact, merely a slight colour variation of *B. nervosa*. The species occurs in the whole range of islands, as well as in Lord Auckland's Is.

Distichophyllum Doz. & Molk., M. frond. ined. Arch. Ind., p. 99 (1846). Mniadelphus C.M. *ex parte*.

The species of this genus are usually quite easy to recognize, while rather hard to define; the leaves are more or less complanate, the lateral ones usually of rather different form from those of the dorsal and ventral series; generally densely set, often undulate when dry, broad and rounded above and obtuse, with or without an apiculus, single-nerved, and usually with a very narrow border of thin, elongate, colourless cells. The texture is usually very soft when moist. The median cells are more or less hexagonal above, generally being much smaller towards margin and apex, while becoming very lax and elongate in the lower part of the leaf. The seta is short, smooth or papillose, sometimes very highly so; the capsules are small, and owing to the short seta and large leaves are often almost concealed.

KEY.

1	Leaves unbordered; plant large; leaves widely rounded and obtuse above	5. *microcarpum*
	Leaves bordered	2
2	Leaves strongly apiculate or cuspidate, more or less denticulate, perichaetial leaves acute	3
	Leaves very wide above, obtuse or with a very small apiculus, usually quite entire; perichaetial leaves obtuse	5
3	Leaves wide and short, sharply denticulate above, stoutly apiculate	1. *rotundifolium*
	Leaves longer, somewhat narrowed above, very undulate when moist, faintly denticulate above, or entire; with a long, acute, often recurved, cuspidate point	4
4	Border rather thickened, upper cells often subrhomboid	2. *crispulum*
	Border very narrow, upper cells regularly hexagonal	2. var. *adnatum*
5	Leaves very broad above, margin generally reflexed; quite obtuse or rarely with a minute apiculus	4. *amblyophyllum*
	Leaves narrower above, with a more or less distinct apiculus; margin not or slightly recurved	3. *pulchellum*

§ I. *Discophyllum* Mitt.

1. **Distichophyllum rotundifolium** (H. f. & W.) Broth. in Engler & Prantl, Pflanzenfam., Musci, ii, 927 (1907).

Syn. *Hookeria rotundifolia* H. f. & W. in Lond. Journ. of Bot., iii, 551 (1844). Fl. N.Z. ii, 123; Handb. N.Z. Fl., p. 493. *H. trichophora* Col. in Trans. N.Z. Inst., xvii, 259 (1884), *fide* Brotherus, *H. smaragdina* Col., op. cit. xviii, 228

(1885), *fide* Brotherus. *H. amoena* Col. op. cit., p. 230. *Distichophyllum crenulatum* C.M. in Hedwig. xii, 121 (1902).

Distinct in the small size, the leaves much crisped when dry, wide and short, distinctly denticulate above, stoutly apiculate. The cells are small (not large, as stated in the Handbook N.Z. Fl.). The seta is short, less than 1cm., and often much shorter, and smooth; the capsule small, the calyptra hairy at apex. The leaves are much less complanate in this species than in most.

I have not been able to see specimens of *Hookeria amoena* Col., but from the description it is certainly this species, as is also *H. crenulata* C.M., of which I have examined the type.

It is a frequent species.

2. **Distichophyllum crispulum** (H. f. & W.) Mitt. in Trans. & Proc. Roy. Soc. Vict., xix, 77 (1883).

Syn. *Hookeria crispula* H. f. & W. in Lond. Journ. of Bot., iii, 550 (1844); Fl. N.Z. ii, 122; Handb. N.Z. Fl., p. 493. *H. flexuosa* Mitt. in Hook. f. Handb. N.Z. Fl., p. 494. *H. subsinuata* Col. in Trans. N.Z. Inst., xviii, 231 (1885).

One of the smallest species, and in habit resembling the last, but with the branches more flattened, the leaves not or scarcely denticulate, narrowed to a rather long, acute, often recurved point. The calyptra is only slightly roughened at apex. The leaf border is rather stouter than in most of the species, especially in proportion to the size of the leaf. Otherwise it is much like *D. rotundifolium*.

No specimens of *Hookeria flexuosa* are to be found at Kew or the British Museum. As Mitten describes it from two stems only, and as intermediate between *H. crispula* and *H. adnata* (which themselves are probably conspecific), and as the only differentiating character mentioned in the description is the fruit-stalk "subscabrid at apex," I think it may be safely merged in the present species. *H. subsinuata* Col. is from the description quite clearly the same thing.

var. **adnatum** (H. f. & W.) Dixon comb. nov.

Syn. *Hookeria adnata* H. f. & W., Fl. N.Z. xviii, 123 (1855); Handb. N.Z. Fl., p. 494. *H. concinna* Col. in Trans. N.Z. Inst. xviii, 229 (1885). *H. cataractae* Col. op. cit., xix, 278 (1887). *Distichophyllum integerrimum* C.M. in Hedwig. xli, 122 (1902).

After careful examination of numerous specimens I have reached the conclusion that this cannot be accorded a higher rank than a var. of *D. crispulum*. It is quite possible that it is simply an epiphyllous form, *D. crispulum* being terrestrial, or on rotten wood. The only structural differences consist in the border, which is very narrow (as in *D. amblyophyllum* and *D. pulchellum)*, and in a slight difference in the cell structure, which however is not constant or clearly marked. In the var. *adnatum* the cells are very regularly hexagonal throughout the upper part of the leaf; in the type they are frequently somewhat rhomboid, or hexagonal-rhomboid, and arranged in more or less regular longitudinal series. Apart from these characters I find no differences at all, though the leaves may be at times more delicate in texture, and filmy, in the variety.

Brotherus considers *Hookeria concinna* Col. and *H. cataractae* Col. as probably to be referred here, and the descriptions I think leave no doubt on the matter. The same is the case with the type specimen of *D. integerrimum* C.M.

The type form of the species appears to be rare, but the var. *adnatum* much less so. I do not know that either has been found in the South I.

3 **Distichophyllum pulchellum** (H. f. & W.) Mitt. in Trans. & Proc. Roy. Soc. Vict. xix, 77 (1883).

Syn. *Hookeria pulchella* H. f. & W. in Lond. Journ. of Bot. iii, 548 (1844); Fl. N.Z. ii, 122; Handb. N.Z. Fl., p. 494.

This species and the next are distinct from the foregoing in the larger size, wider, very obtuse leaves, obtuse perichaetial leaves, and longer seta, usually fully a centimetre in length, and often considerably more. They are frequently whitish in colour when dry, but this character is not constant. They are more difficult to separate from one another; in fact I doubt if any of the characters drawn from the sporophyte are reliable. I believe, however, that the leaves, normally apiculate, and with the margin plane, will always separate the present from *D. amblyophyllum*, which has the leaves occasionally minutely apiculate, as here, but far more usually quite obtuse, and the margin more or less reflexed, so that the ventral surface of the leaf at margin and apex is convex. If these characters should prove unreliable, then the two species will certainly have to be merged into one.

It appears to be a frequent species, on rotten wood and on the ground.

4. **Distichophyllum amblyophyllum** (H. f. & W.) Mitt. op. et loc. cit. (1883).

Syn. *Hookeria amblyophylla* H. f. & W., Fl. N.Z. ii, 123 (1855); Handb. N.Z. Fl., p. 494. *H. sinuosa* H. f. & W., Fl. Tasm. ii, 219 (1860); Handb. N.Z. Fl., p. 494. *Distichophyllum Zuernii* Schlieph. e C.M. in Hedwig. xli, 121 (1902). *Hookeria microclada* Col. in Trans. N.Z. Inst. xviii, 239 (1885).

The most frequent species, and varying considerably in habit, and in minor leaf characters, but structurally a fairly constant plant. I quite agree with Rodway (Tasmanian Mosses) that *D. sinuosum* cannot be separated from *D. amblyophyllum*; there are no characters of any importance, as may be seen from a comparison of the descriptions, e.g. in the Handbook, where absolutely the only distinction is that *D. sinuosum* has leaves apiculate, while in *D. amblyophyllum* they are quite obtuse; this however is quite unreliable, as leaves of both forms may be found on the same stem.

I have examined original specimens of *D. Zuernii*, and find them identical with the present plant, and there can be no doubt that the same is the case with *Hookeria microclada* Col., of which, however, I have only seen the description.

§ II. *Mniadelphus* Mitt.

5. **Distichophyllum microcarpum** (Hedw.) Mitt. op. et loc. cit. (1883).

Syn. *Hypnum microcarpum* Hedw. Sp. Musc., p. 214 (1801). *Hookeria microcarpa* H. f. & W., Fl. N.Z. ii, 123; Handb. N.Z. Fl., p. 495. *Distichophyllum aloma* C.M. in Hedwig. xli, 120 (1902) (*fide* Brotherus). *Hookeria sciadophila* Col. in Trans. N.Z. Inst. xvii, 259 (1884) (*fide* Brotherus). *Hookeria maculata* Col. op. cit., xviii, 284 (1885) (*fide* Brotherus).

Quite distinct in the large size, resembling *Pterygophyllum denticulatum* var. *robustum*, and in the borderless, quite entire leaves with very small upper cells. The length of the seta and the size of the capsule vary greatly. The nerve is long and single, not wanting, as erroneously stated in the Handbook.

It is a frequent species.

Eriopus (Brid.) C.M. in Bot. Zeit. 1847, p. 828.

A small genus of very striking, hygrophytic or semi-aquatic mosses; the general habit is of Pterygophyllum, but the structure very different. The leaves are more or less rounded, with a distinct and usually stout border, and the nerve is very short and forked from the base, or may be wanting. The most peculiar feature, though not common to all the species, is the armature of the seta; that of *E. cristatus* may be taken as typical. The short, stout seta is abruptly bent at the apex, just below the capsule; the lower part is rather closely set all round with coarse, unicellular spines or bristles, more or less at right angles to the seta, and varying in length up to half the diameter of the seta; in the upper half they become gradually longer and usually denser, quite equalling in length the diameter of the seta. Finally, as they approach the angle at the apex of the seta they become still longer, more crowded, parallel and pointing upwards, and collected on the outer or upper side of the seta, so that just at the bend they form a dense brush or beard, out of which the capsule emerges. In *E. flexicollis* the uppermost hairs forming the brush are distinctly articulate about the middle; I have not seen this in *E. cristatus*, and believe they are all unicellular in that species. I have seen no discussion as to the function of this peculiar brush or crest.

KEY.

1	Border extremely narrow, as in Distichophyllum, apiculus slender	4. *Brownii*	
	Border much wider, often very stout		2
2	Border very stout, cartilaginous, entire or subdenticulate; upper cells 25-35 μ	1. *apiculatus*	
	Border scarcely cartilaginous, strongly toothed		3
3	Robust plant; upper cells 50-60μ	2. *cristatus*	
	Slender plant; upper cells 15-20μ	3. *flexicollis*	

(Note.—The upper cells, as in Distichophyllum, are usually markedly smaller towards margin, and rapidly become much enlarged lower down the leaf, so that the comparison of the cell magnitude depends for its value on the same position being selected. I have given measurements of the median cells well below the apex, but not far down, at say one-fifth to one-fourth down the leaf).

1. **Eriopus apiculatus** (H. f. & W.) Mitt. in Journ. Linn. Soc., Bot., xii, 393 (1869).

Syn. *Hookeria apiculata* H. f. & W. in Lond. Journ. of Bot. iii, 549 (1844); Fl. N.Z. ii, 122; Handb. N.Z. Fl., p. 493. *Distichophyllum platyloma* C.M. in Hedwig. xli, 121 (1902).

A smaller species than the two following, usually in dense, tomentose tufts, and it would seem less frequently fruiting. It is recognized at once by the very stout, cartilaginous border, which is entire or slightly denticulate only; by the very stout, acute, cuspidate point, the absence of nerve, and the size of the cells, which are isodiametric as in *E. cristatus*, but much smaller, about 25-35μ in diameter, as compared with 50-60μ. The fruit, when present, moreover, is quite distinct, the seta being only lowly papillose, smooth above.

Distichophyllum platyloma C.M., of which I have seen the type, is certainly *E. apiculatus*, a slightly undeveloped form. The cells and general structure agree, but the border is more denticulate than usual.

E. apiculatus is a rare species in N.Z., occurring also in Tasmania, Eastern Australia, Fuegia and Chile.

2. **Eriopus cristatus** (Hedw.) Jaeg. Adumbr. ii, 242.

Syn. *Leskea cristata* Hedw. Sp. Musc., p. 211 (1801). *Hookeria cristata* W.-Arn. Disp. Musc., p. 56; Fl. N.Z. ii, 125; Handb. N.Z. Fl., p. 496. *Eriopus Jelinekii* C.M. in Reichh. Novara Exped., Bot. Theil, Bd. 1, p. 185 (*fide* Brotherus). *Hookeria petrophila* Col. in Trans. N.Z. Inst., xvii, 234 (*fide* Brotherus). *Hookeria leptophora* Col., op. cit., 260 (*fide* Brotherus). *Eriopus Helmsianus* C.M. in Hedwig. xli, 128 (*fide* Brotherus). *Eriopus Zuernianus* C.M. op. et loc. cit. (*fide* Brotherus).

A fine species, resembling in habit *Pterygophyllum dentatum* var. *robustum*, having stems as much as 10 cm. in height, and 5 mm. or more in breadth; smaller forms occur, however, and the size is not enough to separate it from *E. flexicollis*. The leaves are large, 4-5 mm. long or more, variable in size and shape, the lateral often oblong-spathulate, the dorsal more rounded; they are of a thick texture, and when dry are usually much crinkled at the edges. The nerve usually has the longer branch reaching quite to one-third the length of the leaf, or even higher, but is often very short. The cells are very large, and are regularly hexagonal above, and isodiametric; and being very pellucid and the thickness of the leaf quite appreciable, they often show the lateral walls under a high power very distinctly, so that the effect is exactly that of looking into shallow cells of honeycomb. The border is distinct, of 2-3 rows of elongated cells, incrassate, but not as in *E. apiculatus*, so that the border is green, not yellow and cartilaginous as in that; and it is more or less strongly toothed above; the apiculus is short and wide. The seta is about 1-1.5 cm. in length (cfr. description of genus); the calyptra widely campanulate, strongly fringed at base, and highly tuberculate at apex.

E. cristatus is a frequent moss in damp places in both Islands, and is confined to New Zealand, unless, as I somewhat suspect, *E. tasmanicus* Broth. be a form of the same species; I have seen small forms of *E. cristatus* from New Zealand which agree very closely with the description of *E. tasmanicus*, which was described from sterile specimens; Rodway's description of the fruiting plant, however, indicates some slight differences.

3. **Eriopus flexicollis** (Mitt.) Jaeg. Adumbr. ii, 242.

Syn. *Hookeria flexicollis* Mitt. in Hook. f. Handb. N.Z. Fl., p. 496 (1867). *Hookeria pygmaea* Col. in Trans. N.Z. Inst. xviii, 235 (1886). *Hookeria semiserrulata* Col. op. cit. xxi, 45 (1888).

A much smaller and more graceful plant than the preceding, though some forms of that may come near it; stems about 3 cm. long, rarely up to 3 mm. wide; not caespitose. Leaves about 2 mm. long, more distant, less solid; undulate when dry, but not markedly crisped at margin; border in proportion stouter, 3-4 seriate. Cells at the same point 15-20μ wide, usually slightly *elongate*-hexagonal. Apiculus longer, very acute. Nerve very short. Hairs of crest on seta articulate. Calyptra hairy at tip.

Probably less common than *E. cristatus;* I have it from both Islands.

I have been unable to see specimens of the two species of Colenso's placed in the synonymy; but from the descriptions there can be little doubt that they belong here. Colenso mentions that he has not seen *E. flexicollis*, and says that his *E. pygmaea* is near to it. The only slight discrepancy appears to be that he describes the (young) calyptra as having a shining tip, which does not seem quite consistent with the hairiness of *E. flexicollis.*

4. **Eriopus Brownii** Dixon sp. nov. (Plate X, fig. 11.)

Dioicum. *Tenellum*, molle, vix 1 cm. altum, nitescens, sordide viride. Caules graciles, *parce ramosi*. Folia *parva*, plus minusve complanata, sicca flexuosa, haud crispata, 2 mm. longa, e basi *valde angustata, spathulata*, obovata, apice rotundato, obtuso, *breviter tenuiter apiculato;* enervia vel brevissime obsolete uninervia; limbo *perangusto*, e cellulis linearibus *1-2 seriatis tantum* instructo, *integro circumdata;* cellulae magnae, superne regulariter elongato-hexagonae, perpellucidae, *pro genere minusculae*, 20-30μ latae, margines versus vix minores, infra magis magis elongatae, basilares elongate hexagono-rhomboideae.

Perichaetia numerosa, majuscula, bracteis paucis, lanceolatis, erectis, acuminatis, internis 1-2 late ovatis cuspidatis, inferne serrulatis. Archegonia numerosa. Seta circa 3 mm. longa, crassiuscula, *flexuoso-cygnea,* ubique, praecipue ad apicem tuberculis perhumilibus hyalinis leniter corrugata (platytuberculata). Theca *minima,* cum operculo vix 1 mm. longa, horizontalis vel subpendula, badia, turgide ovata, operculo *brevirostri,* pallido. Calyptra minima, conico-campanulata, apice laevi, inferne ciliis *fuscis* densissime obtecta.

Peristomii dentes externi arcte lamellati, lamellis lateraliter valde, externe leniter prominentibus; intus valde pectinati, sulco mediano latissimo (spatium vero inter dentes ipsos aequante) inferne divisi; fusci, ad basin rubri; endostomii membrana altiuscula, processubus anguste lanceolatis, late perforatis, leniter papillosis, ciliis haud visis.

Hab.: Kennedy's Bush, Port Lyttelton Hills, Christchurch. Coll. R. Brown. This appears in Brown's herbarium as " Hookeria; traced 290."

The small size, and the very narrow border of the leaves, together with the rather small areolation for Eriopus, suggested at first a species of Distichophyllum; and on comparing it with *D. enerve* Besch. from Fuegia, it became evident that it was closely allied to that species, scarcely, indeed separable, though constantly, except by the much shorter apiculus of the leaf. Consultation with M. Thériot, however, on the matter has led us to the conclusion that both plants must be certainly placed in Eriopus, the smooth (or almost smooth) seta—shared with *E. apiculatus*—being certainly outweighed by the nerve, the areolation, and other characters.

PTERYGOPHYLLUM Brid., Bry. univ. ii, 341 (1827) ex p.

The New Zealand species of this genus are all hygrophytic; and like some aquatic groups of flowering plants, e.g. the Batrachian Ranunculi, Callitriche, Potamogeton, they are very plastic and variable, so as to provide a difficult problem to the systematist. Hooker in the Handbook N.Z. Flora (p. 492) says "The species of this section are probably all forms of one"; a conclusion with which I should certainly not quarrel, although I have here treated them as comprising two species, in addition to one described since the publication of the Handbook. This plasticity explains the large number of synonyms listed below, due to the creation of a large number of species, mostly by C. Mueller, based on single specimens, without any allowance being made for the well known variation of the New Zealand plants.

KEY.

1	**Plants of all sizes, the frond rarely 5 mm. wide, and usually considerably less; leaves often distant and often blackish ....**	2
	Plants very large; leaves very dense; frond 5-10 mm. wide; green or yellowish	2. *quadrifarium*
2	**Plant usually blackish; leaf margin denticulate or coarsely toothed; cells highly collenchymatous**	1. *dentatum*
	Plant green; leaf margin entire or finely crenulate; cells not markedly collenchymatous	3. *distichophylloides*

1. **Pterygophyllum dentatum** (H. f. & W.) Mitt., M. austr.-amer. in Journ. Linn. Soc., Bot., xii, p. 397 (1869).

> Syn. *Hookeria dentata** H. f. & W. in Lond. Journ. of Bot., iii, 550 (1844); Handb. N.Z. Fl., p. 495. *H. nigella* H. f. & W., Fl. N.Z. ii, 124; Handb. N.Z. Fl., loc. cit. *Pterygophyllum nigellum* Jaeg. Adumbr., ii, 247. *Hookeria pseudopetiolata* Col. in Trans. N.Z. Inst., xviii, 231 (1886). *H. ramulosa* Col. op. cit., p. 232. *H. subsimilis* Col. op. cit., p. 233. *H. obtusata* Col. op. cit., p. 233. *H. curviseta* Col. op. cit., p. 233. *Hepaticina cyclophylla* C.M. in Hedwig. xli, 124 (1902). *Hepaticina parvula* C.M. op. cit., p. 125. *Hepaticina pseudo-obscura* C.M. op. et loc. cit. *Hepaticina nanocaulis* C.M. op. cit., p. 126. *Hepaticina Zuerniana* C.M. op. et loc. cit.

P. dentatum grows in very wet places, is usually of a dark green or blackish colour, generally turning quite black with age. The leaves when old are often difficult to soak out. The large, obovate-spathulate leaves of all species of this genus are known from the remainder of the Family by the large hexagonal cells, single nerve, and absence of border (the much smaller cells of *Distichophyllum microcarpum*, becoming quite minute at the margin, separate it at once). The nerve tapers away in its upper part, and is frequently unequally forked above; it always ceases at some distance below the apex. The cells are very lax, pellucid and thin-walled, in the upper part very regularly hexagonal, and with collenchymatous thickenings at the angles, which, owing to the transparency of the walls frequently give the appearance of intercellular spaces. The marginal cells, especially in the region of the apex, are usually very much smaller than the internal ones, often semilunar, with the tips projecting so that the margin is erose-denticulate; in addition to this the margin is usually more or less strongly, coarsely toothed, each tooth in some plants formed of two or three cells, of which the terminal one may be more or less distinctly spiniform.

The plants are frequently fertile, but the fruiting characters do not give any constant distinctions between the forms. The seta is smooth, stout, often angular when dry, variable in length, sharply curved at apex so that the fruit is more or less pendulous; the capsule is often somewhat tubercular at the base where it joins the seta. The calyptra is glabrous, somewhat coriaceous, not fimbriate but sometimes slightly lacerate at base; the lid has a straight beak, variable in length.

I have examined the types of the various species described by C. Mueller and given in the above synonymy; they are all merely forms of the one highly variable type.

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*The specific name "denticulata," as I have shown elsewhere, is merely a slip, copied probably by most authors from C.M. Synopsis ii, 203.

Var. **robustum** (H. f. & W.) Dixon comb. nov.

> Syn. *Hookeria robusta* H. f. & W., Fl. N.Z. ii, 124 (1855); Handb. N.Z. Fl., p. 495. *Pterygophyllum robustum* Jaeg. Adumbr., ii, 247. *Hookeria macroneura* Col. in Trans. N.Z. Inst., xviii, 283 (1885). *Hookeria telmophila* Col. op. cit. xix, 271 (1886).

The var. *robustum* is a stout plant, larger in every way, and usually of a dull green, not blackish; but no clear line can be drawn between it and the type. The late Mr. Gray has sent me a fine series from Mauriceville, Wairarapa, showing all gradations in size and also in colour, from the type to good var. *robustum*.

Colenso in describing his *Hookeria obtusata* refers to certain "foreign bodies" on the leaves. I have not seen specimens of the original, but a species of Pterygophyllum gathered in a hothouse at Harrogate, Yorkshire (origin unknown, but certainly belonging to *P. dentatum*) has what is no doubt the same peculiarity; jointed, shortly cylindrical, chlorophyllose, more or less fusiform threads standing out on the leaf, usually round the margin, and frequently so abundant as to form a perfect *cheval-de-frise*. They form without doubt a form of vegetative reproductive organ, which does not appear to have been elsewhere noted.

2. **Pterygophyllum quadrifarium** (Hook.) Brid. Bryol. univ. ii, 347 (1827).

> Syn. *Hookeria quadrifaria* Hook. Musc. Exot., t. 109 (1820); Fl. N.Z., ii, 124; Handb. N.Z. Fl., p. 495. *Mniadelphus quadrifarius* C.M. Syn. ii, 21. *Hookeria luteovirens* Col. in Trans. N.Z. Inst., xvii, 260 (1884) (*fide* Brotherus and Mitten). *H. sexfaria* Col. op. cit., p. 45 (*fide* Brotherus). *H. atrovirens* Col., op. cit., xxi, 46 (1888) (*fide* Brotherus).

This magnificent species, with stems up to six inches long and frequently as much as a centimetre in width, is I think certainly distinct from the preceding group of plants. Apart from the characters given in the Key, the sporophyte is much more robust (which is not by any means the case with var. *robustum* as compared with typical *P. dentatum*). The leaf also is only crenulate-denticulate above, not coarsely toothed, and the cells are very markedly larger (the upper cells in mid-leaf may be up to or over 100μ across). The marginal row in the region of the leaf apex usually consists of very much smaller and narrower cells than the interior ones, of quite different form, being sub-rhomboid, with the apex projecting, so that the leaf is here erose-denticulate.

The leaves are not properly speaking quadrifarious; there appear to me to be normally 4 rows of dorsal and 4 rows of ventral leaves, much smaller and rounder than the lateral, of which there seem to be usually 2 rows on each side. They overlap one another very closely a character which separates the plant at once from *P. dentatum*.

According to the Handbook it is abundant throughout the two Islands; but if so it would surely be much more frequently gathered by collectors than, in my experience, is the case. It is one of the finest of the endemic species of New Zealand.

3. **Pterygophyllum distichophylloides** Broth. & Dixon in Bull. Torr. Bot. Club, xlii, 106 (1915).

This species was described and figured in the above publication. It differs from the other species in the green colour, not turning blackish, the pale stems conspicuous in the dry state owing to the close curling up and crisping of the leaves; the small leaves, quite entire or only minutely crenulate at the apex, and the smaller cells, 30-35 μ wide, not collenchymatous at the angles. Fruit has not been seen.

It was gathered near Auckland by D. Petrie in 1892; and it occurs also in herb. Kew as *Pterygophyllum Colensoi* Broth. n. sp., "Colenso 3115; comm. Rev. W. Colenso xi, 1894; det. Broth. ix, 1895."

HYPOPTERYGIACEAE.

CYATHOPHORUM P. Beauv. Prodr., p. 52.

Cyathophorum bulbosum (Hedw.) C.M., Syn. ii, 54 (1851).

> Syn. *Anoectangium bulbosum* Hedw. Sp. Musc., p. 43 (1801)
> *Cyathophorum pennatum* Brid. Bryol. Univ. ii, 722 (1827), Fl. N.Z. ii, 120; Handb. N.Z. Fl., p. 490.

And

Var. **minus** H. f. & W., Fl. Antarct. i, 143.

> Syn. *C. densirete* Broth. in Oefv. af Finska Vet.-Soc. Foerh. xxxv, 40.

This very beautiful species, which attracts the attention of non-bryological collectors by its size and beauty and its resemblance to a Polypodiaceous fern, is well known to all students. It varies greatly in size, and to a considerable extent in other characters, though the fruiting characters, I believe, are fairly constant, and are striking, though the capsules being produced on the under side of the stem are easily concealed by the leaves.

After much hesitation I have reduced the plant described by Brotherus as *C. densirete* to the status of a variety, as Fleischer has already done, merging it with the var. *minus* H. f. & W. Brotherus distinguished *C. densirete* by the much smaller size, much denser areolation (cells 15-20μ wide), and very short nerve. The length of the nerve I find to be very variable, and not correlated with the remaining characters. The size of the cells is a more important character; the upper cells in the type form range from 25 to 30 μ in width, or thereabouts, and between this and 15-20 there is of course a great difference, and if the character were a well-defined one and constantly related to the small size there would be no hesitation in according the plant specific rank. This however is by no means the case; all gradations in the size of the cells may be found, and equally all gradations in the size of the plant; the smallest plants being by no means always furnished with the smallest cells. I have for instance a plant of Berggren's (No. 2223) which is the smallest perhaps of any of the New Zealand forms I have seen, considerably less than Australian *C. densirete* named by Brotherus, but having the cells as wide as in the type form; and this, with modifications, occurs throughout. I have therefore adopted the original view of Hooker and Wilson, and consider the plant as a variety only, the limits of which, moreover, are difficult to define.

CATHAROMNION H. f. & W., Fl. N.Z. ii, 119 (1885).

This monotypic genus was merged in Hypopterygium in the Handbook, but is, I think, distinctly worthy of generic rank; the erect or suberect capsule, and the single peristome, the outer peristome being wanting, being strong characters apart from the remarkable ciliation of the leaves, unequalled in any other moss.

Catharomnion ciliatum (Hedw.) H. f. & W., op. et loc. cit.

Syn. *Pterigynandrum ciliatum* Hedw. Sp. Musc., 84 (1801). *Hypopterygium ciliatum* Brid., Bryol. Univ. ii, 710; Handb. N.Z. Fl., p. 489.

This very beautiful plant, confined to New Zealand and Tasmania, in dense, bright green tufts, resembles dense tufts of *Hypopterygium novae-seelandiae*, but is known at once by the longly ciliate margins of the leaves, and the presence of axillary setae, or bristles, as well as, when fruiting, the nearly erect, ovoid capsules. The flowers on the ♂ plant are very numerous, and being large and purplish in colour are sometimes very conspicuous.

It appears not to be rare.

HYPOPTERYGIUM Brid., Bryol. Univ. ii, 709.

A very distinct and beautiful genus of mosses, recognized at once by their habit and by the presence of amphigastria or ventral leaves, very different in size and structure from the lateral ones of the frond, which are arranged distichously on the branches. The New Zealand species comprise one or two of the most interesting endemic species of the Island. Their arrangement and the delimitation of the species has given rise to much difficulty, and very great confusion in the nomenclature has been in part the cause and in part the consequence. The genus has been monographed by Kindberg in Hedwig. xl (1901), but his views do not seem to have met altogether with acceptance. I have adopted here his principal divisions, discarding however his divisions of the Subgenus Eu-Hypopterygium.

The Handb. N.Z. Fl. is very unsatisfactory in regard to this genus, showing perhaps the effect of too many hands. The descriptions do not afford a clear conception of the specific differences, and the characters given in Key and in Text are frequently hopelessly at variance, particularly as to infloresccence. Brotherus in the Pflanzenfamilien adopts Kindberg's divisions of Eu-Hypopterygium, but both his diagnoses of these, and the arrangement of the species under each are entirely different from those employed by Kindberg. I have found it on the whole most satisfactory in this group to abandon authorities and rely on my study of the plants themselves.

KEY.

1	Stems pinnately branched, frond elongate; leaves more or less oblong-lingulate	1. *concinnum*	
	Stems dendroid, frond broad, more or less fan-shaped; leaves more or less cordate-oval	....	2
2	Robust, frond 1-2 in. across, branches densely bi-tri-pinnate; leaves small	2. *filiculaeforme*	
	Smaller, frond 1 in. across or much less; branches simple or distantly once pinnate	....	3
3	Axillary bristles numerous and conspicuous	3. *setigerum*	
	Axillary bristles none	....	4
4	Stipes leaves reflexed when moist, stipes naked; leaves undulate when dry, not deflexed	....	5
	Stipes leaves erecto-patent when moist; leaves scarcely undulate when dry, often deflexed on each side of the branch	....	6
5	Seta stout	5. *rotulatum*	
	Seta thin	do. var. *oceanicum*	
6	Stipes tomentose	4. *novae-seelandiae*	
	Stipes naked	do. var. *nudicaule*	

Subgenus I. LOPIDIUM.

Stipes (the unbranched part of the secondary stem) short, with divergent scale-leaves. Frond erect, elongate, more or less regularly pinnate, with simple or slightly pinnate branches. Leaves narrow, oblong-lingulate; cells small, rounded, incrassate. Seta very short, 3-9 mm.

1. **Hypopterygium concinnum** (Hook.) Brid. Bryol. Univ. ii. 714 (1827).

> Syn. *Leskea concinna* Hook. Musc. Exot., t. 34 (1818-1820); Schwaegr. Suppl. iii, Pt. ii, t. 269. (*H. Struthiopteris* auct. plur.; Handb. N.Z. Fl., p. 489; an Schwaegr.?) *Lopidium pallens* H. f. & W., Fl. N.Z. ii. 119 (1855). *Hypopterygium pallens* Mitt. in Trans. & Proc. roy. soc. Victoria, 1882, p. 76.

There has been endless confusion as to the nomenclature of the New Zealand plant. Most authors attribute two species to New Zealand, under the varying names of *H. pallens*, *H. concinnum*, and *H. Struthiopteris*. The Handbook gives them as follows:—

(a) *H. concinnum* (Hook.) Brid. Dioicous. Fruitstalk stout, smooth, ⅙in. long. (b) *H. Struthiopteris* Brid. (*Leskea concinna* Schwaegr., not of Hooker). Monoicous. Seta slender, ¼in. long, rough.

Kindberg gives only *H. pallens* as of New Zealand, confining *H. concinnum* to austral S. America, and with several other authors asserting that *Leskea concinna* Schwaegr. Suppl. t. 269 is not the *Leskea concinna* of Hooker, Musc. Exot., t. 34.

Now as *L. concinna* Hook. is based on Menzies' Dusky Bay plant and on that alone, it is obvious that the name belongs to the New Zealand moss, whether or not the S. American moss be the same species.

In the second place it is absurd to speak of "*Leskea concinna* Schwaegr., not of Hooker," because Schwaegrichen's figure and description are based on the very same plant, viz. Menzies' Dusky Bay moss.

Then as to the supposed differences as given in the Handbook. The only reason for supposing there to be a dioicous plant in New Zealand is, so far as I am aware, the fact that Wilson in herb. notes against Menzies' plant " no ♂ fl. to be seen on the specimen." But Schwaegrichen describes it as monoicous, and this clearly outweighs the negative experience of Wilson, based as it is moreover upon only a stem or two at most. The ♂ flowers in this group, it should be noted, are extremely like the ♀ flowers, and great care is needed in diagnosing the inflorescence. The only other point is that of the seta. This varies in the New Zealand plants from 2.5 mm. to 9 mm. in height, it varies considerably in stoutness, and is practically smooth always or very slightly roughened. The description in the Handbook of the seta of *H. concinnum* as "stout, thickened upwards, scarcely longer than the perichaetial leaves, smooth," is based, no doubt, upon one or two sketches of Wilson's, drawn however from quite immature specimens, and quite at variance with Hooker's figures in the Musci Exotici, from the same plant. (Hooker there goes to the opposite extreme, and makes the seta as much too long and thin as Wilson's sketch represents it too short and stout).

In short there is only one New Zealand species of this group, an autoicous plant, and the only point as to which there is any question is the correct name. This is undoubtedly *H. concinnum* (Hook.), unless the Bourbon plant, *H. Struthiopteris* (Schwaegr.) Brid. be the same thing, in which case the latter name would have priority. As to this, the remarks of the authors of the Bryologia javanica (ii, 9) are very pertinent, and I should be quite prepared to find the S. African and the Australasian plants referable to one and the same species. The Bourbon *H. Struthiopteris* is, however, a much smaller and delicate plant than the Australasian, and in view also of possible difference in the inflorescence I do not think it safe at present to unite them.

H. concinnum is a frequent species, and is easily known by the elongate, pinnate fronds and pale green or yellowish colour. It is, indeed, less likely to be taken for another species of the genus than to be confused, by its superficial resemblance, with some quite different moss; but a very slight examination at once shows its true character.

Subgenus II. FILICULOIDES.

Dioicous. Stipes long; frond more or less horizontal, large, triangular-rounded, rigid; branching bi- or tripinnate; axillary bristles wanting; leaves very small.

2. **Hypopterygium filiculaeforme** (Hedw.) Brid. Bry. univ. ii, 712 (1827); Fl. N.Z. ii, 117; Handb. N.Z. Fl., p. 487.

Syn. *Leskea filiculaeformis* Hedw. Sp. Musc., p. 212 (1801).

This very beautiful, endemic species scarcely needs description. The usually tall, bare stipes, the large fan-shaped, bright green frond, with the branches densely bipinnate and the small neat foliation distinguish it from all the other species.

Subgenus III. STEPHANOBASIS.

Habit of Eu-Hypopterygium. Amphigastria unbordered, strongly serrate. Long, rigid bristle-like setae present in the leaf-axils.

3. **Hypopterygium setigerum** (P. Beauv.) H. f. & W., Fl. N.Z., ii, 118 (1855).

Syn. *Hypnum setigerum* P. Beauv., Prodr., p. 70 (1805). *Leskea tamariscina* Hedw. Sp. M., p. 212 p.p. *Hypopterygium tamariscinum* Brid. Bry. univ., ii, 715; Handb. N.Z. Fl., p. 488. *H. commutatum* C.M. Syn. ii, 6. *H. elegantulum* Col. in Trans. N.Z. Inst., xx, 242 (1887).

Recognized at once by its fairly robust, tall, lax habit and branching, the sharp toothing of the leaves and of the very narrow, unbordered amphigastria, and the numerous long setae arising from the leaf axils on each side of the under face of the branches. These only occur in one other (American) species; the description of them in the "Handbook" under *H. rotulatum* is erroneous. The seta in the present species is short and very stout, especially at apex, and the wide base of the capsule is highly corrugated or tuberculate.

The confusion in the nomenclature arises from the fact that Swartz originally described *Hypnum Tamarisci* from a West Indian species, with which he believed the Australasian plant to be conspecific; Hedwig in the Species Muscorum followed him in this, and figured the Australasian, setiferous plant, as if it were the type of *H. Tamarisci,* which, however, is not the case, and the name *Tamarisci* must be restricted to the American moss. C. Mueller in the Synopsis, recognizing this, created the name *H. commutatum* for the Australasian plant, but this was unnecessary, as Palisot had already given it the name *setigerum.*

Subgenus IV. EU-HYPOPTERYGIUM.

Plants of medium size to very small. Frond more or less rotund or fan-shaped, pinnate or bipinnate. Leaves of moderate size, bordered. Axillary bristles 0.

4 **Hypopterygium novae-seelandiae** C.M. in Bot. Zeit. 1851, p. 562; Handb. N.Z. Fl., p. 487.

Syn. *H. Smithianum* H. f. & W., Fl. N.Z. ii, 118 (1854), et Fl. Tasm., ii, 217 (1860). *H. Hillii* Col. in Trans. N.Z.

Inst. xix, 277 (1887). *H. pachyneuron* Col. op. et loc. cit. *H. vulcanicum* Col. op. cit., xxi, 43 (1889).

var. **glaucum** (Sull.) Dixon comb. nov.

Syn. *H. glaucum* Sull. in Proc. Amer. Acad. Art. Sci. iii, 184 (1855); Musci of U.S. Explor. Exped., p. 26 (159); Handb. N.Z. Fl., p. 488. *H. Smithianum* var. β H. f. & W., Fl. N.Z. ii, 118.

nov. var. **nudicaule** Dixon. Stipes haud tomentosus.

The distinguishing characters of this species as compared with the following are the tomentose stipes; the erecto-patent stipes leaves (though in the dry state they may be somewhat reflexed); the sharply toothed leaves; the amphigastria with usually a stout, long point, and the nerve generally reaching into the point or at least near it; the branches normally rather dense and rigid, little rebranched; the leaves rather closely set, and when dry very little undulate, distichously overlapping, and in most cases much deflexed on each side of the branch, so that the dorsal side of the branch is convex and terete. The nerve of the leaf is often stout, and reaches high up (*H. pachyneuron* Col. is only a form showing this character well).

I find no fruiting characters by which it may be recognized, though the setae are often longer and the capsule larger than they are in *H. rotulatum*, and the capsule is usually pendulous or subpendulous, while in the latter species it is more often horizontal.

The var. *glaucum* in its extreme form is a very marked plant, with minute fronds, which may even measure no more than 5 mm. across, of a glaucous green, sometimes almost white colour, the branches terete and julaceous (above) when dry, the seta very short, the capsule exceedingly short and turgidly oval, frequently rather narrow at the mouth. Intergrading forms however connect it by a continuous chain with the type, and it cannot be considered more than a variety.

The var. *nudicaule*, which appears to be rare, differs in no way, so far as I can detect, from the type except in the stems being non-tomentose. This is in itself, perhaps, a not very important character, but since it is in this species an almost constant and very obvious one, it seems desirable to lay stress on what is a very marked exception and one that may very easily mislead.

The strength of the leaf border varies very considerably, as it does, even more, in *H. rotulatum*, and I do not think it can be used as a specific character; but the toothing is I think always stronger than in that species, though even this varies much, in both the leaves and amphigastria. The descriptions of *H. Hillii* Col. and *H. pachyneuron* Col. are entirely applicable to *H. novae-seelandiae*, and do not suggest any distinguishing characters; Colenso indeed remarks of both of them that they are "pretty closely allied to their New Zealand congeners."

The species is widely distributed, as is also, apparently, var. *glaucum*. The var. *nudicaule* I have from three localities, all in the North I., viz. Blueskin, Waititi, leg. Berggren (2004); Papakami, leg. Berggren (2239); Mauriceville, Wairarapa, leg. Gray (277).

5. **Hypopterygium rotulatum** (Hedw.) Brid. Bryol. univ., ii, 713, (127); Fl. N.Z., ii, 118; Handb. N.Z. Fl., p. 488.

> Syn. *Leskea rotulata* Hedw. Sp. M. 213, t., 51 (1801). *Hypopterygium viridulum* Mitt. in Hook. f. Handb. N.Z. Fl., p. 487. *H. discolor* Mitt. op. cit., p. 488 (1867). *H. Scottiae* C.M. in Linn. xxxv, 619 (1868).

var. **oceanicum** (Mitt.) Dixon comb. nov.

> Syn. *H. oceanicum* Mitt. in Hook. f. Handb. N.Z. Fl., p. 487.

As I understand *H. rotulatum* (I have not seen Hedwig's type—no specimens appear to exist in Schwaegrichen's herbarium—but specimens in Herb. Hook. "*Leskea rotulata* Hedw., N.Zd., Sinclair," and "*Leskea rotulata* Hedw. vera, Auckland, N.Zeald., D. Lyall," may probably be considered authentic), it differs mainly from *H. novae-seelandiae* in the non-tomentose stipes, the leaves of which are reflexed both moist and dry; the laxer, less rigid habit, with the branches more straggling and more frequently rebranched, the duller green colour—*H. novae-seelandiae* is more frequently of a bright or yellowish green; the leaves laxer, when dry strongly undulate, and not deflexed, so that the upper side of the branch is not convex; the border very variable in thickness, but almost constantly less strongly—often indeed very faintly denticulate—the apex less acutely pointed, the nerve generally weaker and shorter, the amphigastria generally with much shorter points, subentire, and with a much shorter, often very weak nerve.

After much hestitation I have reduced *H. viridulum* and *H. discolor* to *H. rotulatum*. I have examined Mitten's plants with some care, and am unable to grasp any characters of any distinction or constancy. The difficulty is much enhanced by the carelessness of the descriptions in the Handbook. A comparison for instance of the descriptions of *H. discolor* and *H. rotulatum* will show that there are no definite characters of any kind by which the two can be separated. It is true that they are clearly differentiated in the Key by giving *H. rotulatum* some interfoliar bristles; but this is entirely erroneous; they do not occur and have never been described or figured for this species. There is the same discrepancy as to inflorescence. *H. oceanicum* is described in the Key as dioicous, in the text as monoicous. *H. viridulum* and *H. rotulatum* are described as monoicous; but the specimens of *H. rotulatum* in Herb. Hook. marked by Wilson as *monoicous* are quite certainly dioicous; I have found purely ♂ and purely ♀ stems, and in no instance have I found both forms of flower on a stem. Moreover *Leskea rotulata* Hedw. is *not* autoicous, but dioicous (see the generic description of Hedwig). In fact I greatly doubt if any autoicous species of this group of the genus occur in New Zealand.

I have seen several plants determined as *H. oceanicum*, from Norfolk I., the Kermadecs, and New Zealand itself, and on most of these I can detect no characters of any value; but on the only two plants determined by Mitten himself, "Kermadec Is., leg. MacGillivray," and "Sunday Sd., leg. Milne," the setae are decidedly thinner than is the case in any of the plants of this group which I have seen, and this is the one character given in the Handbook on which any reliance can be placed. (The length of the lid is certainly of no value, as I have specimens of *H. rotulatum* with quite stout setae showing the beak of the lid fully equalling the capsule in length). I have therefore classed *oceanicum* as a variety, based on this character alone.

Mitten has determined the identity of *H. Scottiae* C.M. with his *H. discolor*.

H. viridulum Mitt. is a very doubtful plant. Mitten's specimens at Kew certainly include two species, one referable to *H. novae-seelandiae*, and one I think to *H. rotulatum*. The only character of any importance given by Mitten is the monoicous inflorescence, a character which does not seem to have been confirmed by any later author, and I think extremely doubtful. Kindberg makes it a subspecies of *H. novae-seelandiae*, scarcely, however, separated by any intelligible characters.

H. rotulatum appears to be widely distributed in the Islands.

INCERTAE SEDIS, &c.

H. ciliatum (Hedw.) Brid. = *Catharomnion ciliatum*.

H. Balantii C.M. was described from a specimen growing on a cultivated plant of Balantium. Its New Zealand origin is doubtful, even if it could be considered to exhibit a normal growth.

H. marginatum Col. and *H. flaccidum* Col. (*H. Colensoi* Par.) are described in Trans. N.Z. Inst., xxi, 44, each from a single stem picked out from among other mosses, a condition on which it is hardly safe to base a new species, even if the characters were more marked than appears from the descriptions. These species should certainly be allowed to drop.

RHACOPILACEAE.

RHACOPILUM P. Beauv. Prodr., p. 36 (1805).

This Family has been usually placed near Hypopterygiaceae, through the analogy of the dorsal leaves here and the amphigastria of the latter. There is, however, no real affinity between the two, and the true taxonomic position of Rhacopilum (with Powellia) is rather uncertain. It is placed by Fleischer between Orthotrichaceae and Fontinalaceae.

The differences between the New Zealand species—excluding *R. robustum*—appear to me very slight and inconstant, and can only be given in comparative terms.

KEY.

1	**Robust; dorsal leaves similar to the lateral in form, and almost as large**	4. *robustum*
	Moderately robust to slender; dorsal leaves much smaller and narrower than the lateral, very narrowly acuminate, with straight, robust arista	2
2	**Leaves tapering and acute, seta thin**	3. *laetum*
	Some leaves at least subobtuse, broader at points	3
3	**Robust, seta very stout; calyptra very hairy**	1. *strumiferum*
	More slender; seta thinner; calyptra sparsely hairy	2. *cristatum*

1. **Rhacopilum strumiferum** C.M. in Bot. Zeit., 1851, p. 563; Handb. N.Z. Fl., p. 491.

Syn. *R. australe* H. f. & W., Fl. N.Z. ii, 121.

Rather more robust than *R. cristatum*, more often yellowish, with larger, broader leaves, which are, however, generally narrower at the points and less obtuse. The seta is often very stout and usually short, about half an inch, but in my experience this character is a much less defined and practical one than is usually implied by authors; I find it highly variable both in length and in thickness.

It is a common species.

R. confusum Card. MS. in sched. from the North I., leg. W. E. Setchell, I cannot distinguish from *R. strumiferum*.

2. **Rhacopilum cristatum** H. f. & W., Fl. N.Z. ii, 121 (1855); Handb. N.Z. Fl., p. 491.

This is usually a much more slender plant, with delicate leaves much crisped when dry, and usually more distant and more oblong and obtuse, the excurrent nerve weaker, but I find some plants very difficult to separate, even in the fertile state, as the seta varies much in length and thickness.

The character drawn from the calyptra is probably a good one, but is rarely available.

The distribution is about the same as in the last, but it is probably less common.

3. **Rhacopilum laetum** Mitt. in Journ. Linn. Soc., Bot., iv, 93 (1859); Handb. N.Z. Fl., p. 491.

This may be a distinct species, marked by the tapering, acute leaves, and thin, longer seta, which may reach an inch in length; but I am doubtful if it is really distinct from the last.

It appears to be rare.

4. **Rhacopilum robustum** H. f. & W., Fl. N.Z., ii, 121 (1855); Handb. N.Z. Fl., p. 491.

The most robust species, with the dorsal leaves almost similar to the lateral, and with a very stout, robust seta and capsule. The leaves are very longly aristate.

Less common than the other species, but found in both Islands.

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NEW ZEALAND INSTITUTE.

BULLETIN No. 3.

STUDIES IN THE

BRYOLOGY OF NEW ZEALAND,

WITH SPECIAL REFERENCE TO THE HERBARIUM OF
ROBERT BROWN.

BY H. N. DIXON, M.A., F.L.S.

PART VI.

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PART VI.

LESKEACEAE.

As adapted by Brotherus this Family comprises several Tribes, including genera which have been variously placed under Leskea, Anomodon, Thuidium, Hypnum, etc. They are characterized by a general Hypnoid growth, uninerved leaves, small, more or less rounded, often papillose cells, and a generally Hypnoid capsule and peristome.

The genera principally belong to the temperate and colder regions, though Thuidium has an equally tropical distribution.

HAPLOHYMENIUM Doz. & Molk. in Ann. sc. nat. 1844, ii, 310.

Haplohymenium Huttonii (Mitt.) Broth. in Engl. & Prantl. Pflanzenfam., Musci, ii, 986.

Syn. *Anomodon Huttonii* Mitt. in Journ. Linn. Soc., Bot., xiii, 309 (1872).

This little known species is endemic in New Zealand, and hitherto only recorded from Gt. Barrier Id., where it was collected by Hutton and Kirk; it grows on the bark of trees.

It is a delicate little moss, only known sterile, with densely branched, wiry stems, bearing minute, almost microscopical, closely imbricated leaves, which are appressed when dry, so that the branches are julaceous, but moisten out rapidly, and being very uniform in size and direction, more or less complanate, they give a very plumose appearance to the branches under the lens. They are lingulate from a wider base, crenulate-denticulate at margin above, obtuse or very minutely apiculate, nerved for about two-thirds their length, with the very obscure and opaque, densely papillose cells which are characteristic of the Tribe Anomodonteae, as is also the bi-lateral asymmetry which the leaves often exhibit.

The original locality for the plant is rather dubious. Kirk, in a paper on the Flora of the Isthmus of Auckland in Trans. N.Z. Inst., iv, 229, refers to it as "Anomodon Huttonii n. s. (originally discovered at Omaha)" and adds that it has not been found south of Auckland. He makes no reference to it, however, in his paper on the Flora of Omaha Bay (op. cit., vol. v); while Mitten in his description of the species gives only "Gt. Barrier Id., *Hutton & Kirk*," and it certainly exists from there in Hutton & Kirk's collections, and I have also received it from the late Mr. W. Gray, who collected it there in 1922. The matter is of no great importance, as it certainly occurs on the mainland also; I detected it among some unnamed mosses collected by S. Berggren in 1874, from Hokianga, in the extreme north of Auckland.

Haplohymenium pseudo-triste (C.M.) Broth. from S. Africa is quite probably identical. I have not been able to detect any differences. Both plants have, however, only been found in the sterile state, and it would perhaps be premature to unite them. If, however, they should prove to be conspecific, Mitten's name would have to give way.

PSEUDOLESKEA Bry. eur., fasc. 49-51 (1852).

A fairly well defined genus, widely distributed in the northern hemisphere; differing from Thuidium in the irregular branching, few or no paraphyllia, and the stem leaves little differentiated from the branch leaves; it is characterized by short, more or less rhomboid cells, which are smooth or more often papillose (either by the projection of the apex or by a single central papilla). The capsule is more or less curved and asymmetric, and the inner peristome without cilia.

Pseudoleskea imbricata (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1000, fig. 728.

Syn. *Leskea imbricata* H. f. & W., Fl. Tasm., ii, 202 (1860).
Cryphaea imbricata Mitt. in Trans. & Proc. Roy. Soc. Victoria xix, 80 (1883).

This species has only recently been recorded (by Brotherus, loc. cit.) from New Zealand; I have specimens from Oamaru, leg. R. Brown ter., and from Otago, leg. Petrie (Totara, nr. Oamaru, No. 136, and Roxburgh, No. 592). The Roxburgh plant was sent by T. W. N. Beckett to C. Mueller, and determined by him as *Pseudoleskea calochlora* n. sp., but it is inseparable from the Tasmanian and Australian plant. It appears to be rare. It is readily known by the dense tufts with crowded erect branches, of a brownish colour, the leaves very densely crowded so that when dry the branches are terete and julaceous, though the leaves are widely spreading when moist. They are widely cordate-oval, very shortly pointed, with a stout but rather ill defined nerve reaching nearly to the apex; the margin finely denticulate, the cells small, oval-rhomboid, almost equal throughout the leaf, but at the basal angles becoming smaller, transversely oval and opaque, forming large triangular alar bands.

The seta is not much longer than the branches, the capsule small, suberect, shortly cylindrical, slightly curved and asymmetric; the lid conical and acute.

It is very closely allied to the S. African *P. claviramea* C.M.

THUIDIUM Bry. eur., fasc. 49-51 (1852).

The species of this large and distinct genus are divided into five subgenera, of which two only, Thuidiopsis Broth., and Eu-Thuidium Lindb. are represented in New Zealand.

Of Thuidiopsis four or five species have been recorded from New Zealand, differing from one another in size, habit, branching, etc., but manifesting a great tendency to vary and to pass into one another by intermediate forms; and I think quite possibly all forms of a highly plastic type; the fruiting characters even when present appear to give no defined characters, and the minute structure of the leaves very uncertain ones. The characters given by some authors are very misleading; thus the Handbook separates *T. furfurosum* and *T. fulvastrum* from *T. sparsum* as having the stems simply pinnate. All these species, on the contrary are equally bipinnate.

The distinctions between these forms are perhaps best given by a brief description of their main features rather than by a Key.

The typical form of *T. furfurosum* is a tall, bright green or golden plant, with elongate, regularly and distantly pinnate fronds, having the primary branches rather stout and tapering at ends; the secondary branches very delicate and minute-leaved. The dimorphism of the stem and branch leaves is very marked. Forms occur, however, with stem and branches all more or less uniformly filiform and minute-leaved. The ramuline leaves are narrowly pointed with the points much incurved when dry, so that the branches are catenulate. This position of the leaves when dry is characteristic of the Subgenus Thuidiopsis.

When the branching is very dense and regularly pinnate, and the branches of almost equal length, so that the frond is linear and compact it is *T. fulvastrum* (Mitt.).

When the plant is slender, very densely matted with short stems, shortly and densely branched with short branchlets, and little differentiation between the stem and branches or between the branches and branchlets, the stem leaves also being more shortly pointed, the branch leaves very wide and shortly pointed or almost obtuse, concave, and little altered when dry, it is *T. sparsum*. This is usually dark green or dull brown.

Subgenus A. Thuidiopsis Broth.

Moderately robust plants; stems not arched and rooting at the tips, nor stoloniferous; paraphyllia usually short. Branch leaves incurved-catenulate when dry, nerve smooth at back; cells with numerous, low papillae. Seta thin.

1. **Thuidium furfurosum** (H. f. & W.) Jaeg. Adumbr., ii, 322.

Syn. *Hypnum furfurosum* H. f. & W., Fl. N.Z., ii, 107 (1855); Handb. N.Z. Fl., p. 471. *H. unguiculatum* H. f. & W., Fl. Tasm., ii, 208.

A common and very variable plant; but one as a rule easily recognized by the habit and the foliation. As already mentioned, the branching is always bipinnate, not singly pinnate as described in the Handbook.

var. **fulvastrum** (Mitt.) Dixon comb. nov.

Syn. *Leskea fulvastra* Mitt. in Journ. Linn. Soc., Bot., iv, 92 (1859). *Hypnum fulvastrum* Hook. f., Handb. N.Z. Fl., p. 471.

This plant has no structural characters, but is a peculiar form of *T. furfurosum.* The original plant is not a very marked form, and Mitten indeed does not appear to have considered the branching as of importance; other specimens which I have show a very remarkable habit, the branches being exceedingly dense, equal in length, and short, so that the frond is of a curious form and texture; the stem also is extremely tumid, owing to the very dense arrangement of the leaves, and the paraphyllia. Intermediate forms are however frequent. I have not seen it fruiting.

2. **Thuidium sparsum** (H. f. & W.) Jaeg. Adumbr., ii, 322.

Syn. *Hypnum sparsum* H. f. & W., Fl. N.Z., ii, 109 (1855); Handb. N.Z. Fl., p. 471. *H. suberectum* Hampe in Linn. xxx, 638 (1859-60). *Thuidium suberectum* Jaeg. Adumbr., ii, 312.

This is one of the most marked outliers of the *T. furfurosum* group, and is marked by a simplification and abbreviation of all its parts; the stem leaves are much more shortly acuminate—hence more like the branch leaves; the branches and branchlets are short, rigid, subequal in size, the rameal and ramuline leaves being subsimilar, all wide, short, cymbiform, bluntly pointed and not at all acuminate, very lowly papillose, with pellucid nerve. I have seen very few fruiting specimens.

In Journ. Linn. Soc., Bot., 1913, p. 328, I referred a New Zealand moss to *T. suberectum* (Hampe), and since then I have received numerous specimens which all seemed referable to the same species. Examination of a large series of plants however has convinced me that Hampe's plant cannot be separated by any definable characters from *T. sparsum,* of which it is a rather robust form.

A very remarkable state occurs in the extreme north of the Island, especially on Gt. Barrier Id., apparently in very shady, damp habitats, with large, lax, deep green foliation, the ramuline leaves very little smaller than the rest, large, elongate, very little concave, and often with a tendency to a complanate, bifarious arrangement similar to that of some tropical species, e.g., the African *T. laevipes* Mitt. The leaves also are irregularly crisped when dry. If it had not been for the presence, in one case, of intermediate forms connecting it with *T. sparsum*, I should not have thought of placing it here.

A less strongly marked state of the same thing was sent me from the New York Bot. Garden as "*H.* (Tamariscella) *incompleto-pinnatum* C.M. in sched., Greymouth, N.Z.; R. Helms." The same form was also collected at Dunedin by Berggren (No. 2558).

Subgenus B. EU-THUIDIUM Lindb.

Mostly robust, rigid plants. Dioicous. Stems frequently arched, rooting at the tip, and with stoloniferous prolongations, so as to be interruptedly frondose; irregularly bi- or tri-pinnate. Paraphyllia usually high, more or less foliose. Branch leaves not incurved-catenulate when dry; cells unipapillose. Seta more or less thick.

{Nerve of ramuline leaves prominent at back ...... 3. *laeviusculum*
{Nerve of ramuline leaves not prominent at back ...... 4. *denticulosum*

3. **Thuidium laeviusculum** (Mitt.) Jaeg. Adumbr., ii, 324.

Syn. *Leskea laeviuscula* Mitt. in Journ. Linn. Soc., Bot., iv, 92 (1859). *Hypnum laeviusculum* Hook. f., Handb. N.Z. Fl., p. 471.

Quite distinct from the preceding species in the habit of growth, the interrupted branching, the densely pinnate ramuli (in all the previous plants the ramuli are sparse, except in *T. furfurosum* var. *fulvastrum*, which is quite different); and in the character of the ramuline leaves. These are more or less closely imbricated both moist and dry, so that the branches are catenulate at all stages, though not from the incurving of the dry leaves. They are very small, slightly spreading with erect tips, so that the upper part is parallel to the axis of the branch; and the nerve is highly prominent and slightly cristate at back, often terminating abruptly in a spicule. The seta is long and stout; the capsule large.

"*H.* (Tamariscella) *chlorophyllosum* C.M. MS. in sched.; Greymouth, R. Helms," herb. New York Bot. Gard., belongs here, as does also *Thuidium bipenne* Wils. MS. in herb.

4. **Thuidium denticulosum** (Mitt.) Jaeg. Adumbr., ii, 324.

Syn. *Hypnum denticulosum* Mitt. in Hook. f. Handb. N. Z. Fl., p. 472.

This must remain a doubtful species. Only two or three stems occur in Mitten's herbarium, of which Mrs. Britton has kindly sent me a part. So far as can be judged from this it is a plant similar to the last, but with the branches less densely ramulose, the rameal leaves much more resembling the stem leaves than the ramuline ones; the latter larger than in *T. laeviusculum*, decidedly more longly and narrowly tapering, with a thinner nerve, not projecting at back, though frequently terminating in a minute, spiculose point. It may be hoped that it will be rediscovered in sufficient quantity to allow of a clear idea of its characters.

HYPNUM.

The species of the genus *Hypnum*, as treated in the older works, have been distributed in recent times not only over many genera, but even among several Families. It may be convenient to give here some guidance as to the groups under which the New Zealand species are to be sought; several genera (Echinodium, Lembophyllum, Thuidium) having been already dealt with. The following Key will assist towards this.

1	Nerve single	2
	Nerve 0 or double	4
2	Lid with a long beak	Brachytheciaceae (excluding *Brachythecium*)
	Lid conical or mamillate	3
3	Seta more or less rough	Brachythecium (excluding *B. salebrosum*)
	Seta smooth	Amblystegiaceae
4	Alar cells large, inflated, often orange; lid with a long beak	Sematophyllaceae
	Alar cells not inflated; lid obtuse or shortly rostellate	5
5	Leaves more or less complanate, very rarely falcate-secund	Plagiothecieae
	Leaves more or less falcate	6
6	Capsule inclined, more or less oblong, asymmetric	Stereodonteae
	Capsule usually pendulous, short and thick, symmetric, usually urceolate when dry	Ectropothecieae

The above Key may help to classify the Hypnaceous species remaining to be dealt with; but it is almost impossible to do this in the form of a key with any degree of completeness; certain species refusing to conform to what are the usual characters of a genus, and the genera themselves being based on a combination of characters very difficult of definition; so that the student who has some acquaintance with the groups may often be able at once to refer a species to its genus, and yet find it very difficult to give the exact grounds for such a reference.

I have modified to some extent the treatment of Brotherus—to which I have for the most part adhered—in the direction of what appears to me a somewhat broader and simpler classification; especially in the Brachytheciaceae.

It may be helpful to give side by side the divisions of Hypnum as used in the Handbook of the N.Z. Flora and those adopted here.

HANDBOOK.	PRESENT ARRANGEMENT.
Tamariscina	Thuidium
Adunca	Drepanocladus
H. filicinum	Amblystegium
H. limbatum	Hypnodendron marginatum var.
Hispida	Echinodium
Cupressiformia	Rhapidostegium and Stereodon
H. pubescens	Ctenidium
H. molliculum	Isopterygium
H. limatum	Isopterygium
H. pulchellum	Isopterygium
H. acutifolium	Rhapidostegium
H. sandwichense	Ectropothecium
Praelonga	Eurhynchium
Conferta	Rhynchostegium
Rutabula	Brachythecium
Serpentia	Amblystegium
Stellata	Campylium
Acicularia	Ptychomnion
Cochlearifolia	Lembophyllum and Weymouthia
H. chlamydophyllum	Acrocladium auriculatum
H. inflatum	Eucamptodon inflatus
Distichophylla	
H. extenuatum	Acanthocladium
H. politum	Catagonium
H. polystictum	Taxithelium
H. denticulatum	Plagiothecium

SEMATOPHYLLACEAE.

Plants of varying habit; leaves nerveless, with very narrow upper cells, and a few large, orange or hyaline, inflated cells at the basal angles. Capsule small; lid (except in *Acanthocladium extenuatum*) with a long, fine beak.

ACANTHOCLADIUM Mitt. Austral. Moss. in Trans. & Proc. Roy. Soc. Victoria, xix, 85 (1883).

A small genus with its centre of distribution in South-East Asia, extending to Africa, and (in the present species) to Australasia, with one or two S. American representatives.

Acanthocladium extenuatum (Brid.) Mitt. op. et loc. cit.

Syn. *Hypnum extenuatum* Brid. Bry. univ. ii, 484 (1827); Handb. N.Z. Fl., p. 481. *Hypnum crinitum* H. f. & W., Fl. N.Z. ii, 114.

Readily known by the leaves, either abruptly contracted or gradually tapering to a longer or shorter filiform hair-point, together with the enlarged, vesicular alar cells. The plants vary immensely in habit, but are usually of a pale, greyish or yellowish-green colour, laxly and widely caespitose, rather robust, with the branches generally tapering to a fine, convolute point. The leaves vary remarkably, both in size and outline, being sometimes large, oblong-ovate, broad and cucullate at tip, and abruptly contracted to the hair-point; at other times extremely narrow, lanceolate-acuminate, and gradually tapering. The hair-point is sometimes very short, merely a cuspidate point, but some leaves will always show the piliform arista. The seta is rather long, the capsule horizontal or suberect, rather bright red, with a deep red, acutely conical lid.

It is a frequent plant, and extends all over the Australasian region.

RHAPHIDOSTEGIUM (Bry. eur. as subgenus) De Not. Cronaca ii, 31 (1867).

A clearly marked genus, distinguished by the nerveless leaves, with enlarged, usually very distinct and inflated alar cells, and small capsule with a long, subulate or rostrate beak. The texture of the exothecium is also markedly different from that of most, at least, of the Hypnaceous mosses, the cells being short, wide, almost isodiametrical, and with the walls highly thickened at the angles.

The inflorescence is important, but needs very careful examination, as the ♂ flowers are unusually small. The species are difficult to distinguish, and have given rise to much confusion and uncertainty.

KEY.

1	Robust plants; leaves rather large, wide, not finely subulate	5
	Slender plants, leaves small, very narrowly subulate or filiform	2
2	Leaves straight, nearly erect or pointing upward; autoicous	5. *contiguum*
	Leaves straight, erect, not pointing upward; dioicous	4. *acutifolium*
	Leaves more or less falcate and curved downwards	3
3	Autoicous; seta almost always above 1 cm.; leaves falcate, branches obtuse, not cuspidate	1. *amoenum*
	Some branches at least cuspidate at points; seta 1 cm. or under	4
4	Dioicous; seta rather stout, slightly roughened at apex; perichaetial leaves sharply denticulate	2. *leucocytus*
	Autoicous; seta thin, smooth; perichaetial leaves entire	3. *Dallii*
5	Alar cells orange, incrassate, not inflated; dioicous	8. *homomallum*
	Alar cells vesicular; autoicous	6
6	Leaves widely acuminate, falcate; seta smooth	6. *tenuirostre*
	Leaves not acuminate, secund, not falcate; seta roughened above	7. *Jolliffii*

1. **Rhaphidostegium amoenum** (Hedw.) Jaeg. Adumbr. ii, 466.

Syn. *Hypnum amoenum* Hedw. Sp. M., p. 292, t. 77 (1801); Handb. N. Z. Fl., p. 474. *Hypnum cyparioides* Brid. Musc. Rec. ii, Pt. 2, p. 138 (1801). *Stereodon cyparioides* Mitt. in Journ. Linn. Soc., Bot., iv, 87. *Hypnum leptorrhynchum* H. f. & W., Fl. N.Z. ii, 112; Handb. N.Z. Fl., p. 475 (An *H. leptorrhynchum* Brid. ?). *H. mundulum* H. f. & W., Fl. N.Z. ii, 112; Handb. N.Z. Fl., p. 476.

There has been much confusion as to the plants included here, and they have been placed under several different names, the nomenclature varying much from time to time according to the opinion of authors as to the identity of the New Zealand plants with early described species. This has applied principally to *Hypnum amoenum* Hedw. and *H. cyparioides* Brid. Authors have displayed much ingenuity in seeking to detect and point out the differences between these two species, when it would perhaps have been more profitable to ascertain whether there was any reason to suppose them distinct. C. Mueller in the Synopsis says that “ *H. cyparioides* is ‘facile discernibile’ ” by its small size and the characters given by him; and of *H. amoenum* that it is at once distinguished from all its congeners by the characters emphasised in the description. On careful study one finds that the characters resolve themselves into *H. cyparioides* being placed among the slender plants, and *H. amoenum* among the more robust, while *H. cyparioides* is credited with a very thin seta, *H. amoenum* with a stout one. Original specimens of the authors not being available, we can only form conclusions by studying the available plants themselves.

H. amoenum was based on a plant of which Hedwig's only record is “ Seelandia”; Bridel's on a plant collected by La Billardière in “ Nova Hollandia.” Neither author at any time compares his species with the other; both were in fact described and published almost simultaneously. The presumption in a genus of so few species (in the Australasian region) would be that the two species were identical rather than otherwise. Bridel in a later work, it is true, describes both his *H. cyparioides* and Hedwig's *H. amoenum*; but he places the latter under Isothecium, and describes it from S. American specimens, adding that it is recorded from New Zealand, but that this is scarcely credible; quite ignoring that it was on a New Zealand plant that Hedwig founded his species, with no reference to any American ones! I take it that it was due to following Bridel in this that Hooker and Wilson in the Fl. N.Z do not include *H. amoenum* at all, merely giving a passing reference to it in one place. In the Handbook Mitten has restored it, but without succeeding in giving any comprehensible distinguishing characters from the other plant, known there as *H. leptorrhynchum*.

As to C. Mueller's characters, that of “ tenella” as against “ robustiora,” only signifies that there are fairly robust as well as slender forms. I have seen no setae that could be described as “ crassae”; the seta varies considerably in length, and the longer forms are usually appreciably though slightly thinner than the shorter ones, but I have sought in vain for any characters that are correlated with these differences, even if they were far more marked than they actually are. Other characters that have been suggested are the greater or less degree of falcation of the leaves, the denticulation of the apex, the margin plane or recurved, and the form of the perichaetial leaves; but while these vary to some considerable extent, they do not appear to be in any way associated either with one another or with any other characters.

As to C. Mueller's distinctions, although too much stress must not be laid upon Bridel's figures, it may be noted that they represent, for *H. cyparioides*, a plant that so far from being "tenellum" is decidedly larger than any plant I have seen of the group! As to the character of the seta, while it does, as remarked above, exhibit some degree of variation, and a greater length is perhaps generally associated with a lesser thickness, the differences are exceedingly slight, and I have certainly seen no seta which could fairly be described as "crassa."

The serrulation of the leaves offers no distinctive character, but all degrees may be found from a fair degree of denticulation to perfectly entire; the margin of the leaf is equally elusive, it being frequently recurved in leaves on the same stem where the majority are plane-margined.

The perichaetial leaves vary considerably, and I had hoped to find some distinctive character there, since in the present genus these may be a very safe guide in the determination of species where other characters afford little help; I have, however, found the different forms entirely unassociated with any other of the distinguishing characters suggested above. The bracts may be shortly and broadly pointed, or gradually narrowly acuminate, or quickly attenuated from a wide, sheathing base to a subfiliform, denticulate subula; but they are never very longly and finely acuminate or subpiliferous, nor very widely spreading.

In all probability other Australian plants such as *R. calliferum* Hampe & Geheeb, and *R. callidioides* Hampe & C. M., are referable here, but I have not studied them closely.

H. mundulum H. f. & W. certainly belongs here; it is a fairly robust plant with the old capsules of a deep purplish-brown, but in other respects exhibits no difference from *R. amoenum* except in respect of the lid, described as "shorter than the capsule." I have examined all the plants in Hooker's and Wilson's herbaria, and I find only four lids, two considerably shorter than the capsule and with rather stout beaks, and one of approximately the same length as the capsule, and also rather stout. These are the form figured in the Fl. N.Z. Wilson has the following MS. note, "H. may be only a large variety of *H. leptorrhynchum*, with the operculum shorter than usual, and the stem more densely pinnate. W. W. Feb. 3, 1858." This view is without doubt correct, and the only question remains whether it is deserving varietal rank. I should certainly have accorded it this, but for the existence of a single operculate capsule (the fourth of those mentioned above) in Wilson's herbarium, with the lid not only fully as long as the capsule, but with the fine beak characteristic of normal Rhapidostegium. I think therefore it must be looked upon as merely a form or sport.

R. amoenum is quite easy to recognize; it generally grows in dense soft green or yellowish tufts, with the leaves strongly and prettily decurved, and often quite circinate; the long filiform acumen giving it somewhat the appearance of *Stereodon cupressiformis*, from which however the structure of the leaf base at once separates it, as well as the strongly rostrate lid; it is usually abundantly fruiting, and the short, red setae and orange-brown capsules are very conspicuous. The capsule varies in form and direction, being either horizontal, or less frequently almost pendulous; it may be gibbous above or quite straight and symmetrical; and it may either have a short tapering neck, or more frequently it passes abruptly into the seta, with a slightly enlarged annular thickening at the base in the place of a collum; this, in fact, is often a very marked feature; the different forms often occur on the same plant. The beak of the lid may be either straight or curved. It is a common species.

2. **Rhaphidostegium leucocytus** (C.M.) Jaeg. Adumbr. ii, 469.

Syn. *Hypnum leucocytus* C.M. Syn. ii, 314 (1851). *H. cerviculatum* H. f. & W., Fl. N.Z. ii, 113 (1855); Handb. N.Z. Fl., p. 473. *Rhaphidostegium cerviculatum* Jaeg. Adumbr. ii, 469.

The authors of the Handbook have unfortunately introduced further confusion into this group by their description of *H. cerviculatum* as a new species and their reference of *H. leucocytus* C.M. to their *H. leptorrhynchum*. As a matter of fact both *H. cerviculatum* and *H. leucocytus* are founded upon the same material, the Auckland Is. plant named at first by Wilson *H. leptorrhynchum*. In both Wilson's herbarium in the Brit. Mus. collection, and in Hooker's herbarium at Kew, these Auckland Is. specimens, labelled W. 81 and W. 82, and at first written in as *H. leptorrhynchum*, are later made the basis of *H. cerviculatum*; and the name must give way to C. Mueller's, published four years earlier.

H. leucocytus is a quite distinct species. (The figure 786 in Brotherus, Musci—as *Rhaphidostegium cerviculatum*—is very misleading, and must certainly have been taken from an incorrectly named specimen.) Its characters are a dioicous inflorescence, the leaves *not* strongly falcate (though variable), usually indeed only slightly so; the colour is generally very pale green, and not glossy; the stems and branches are normally markedly cuspidate from the penicillate apical leaves, though many branches may be without this feature; the habit is not at all unlike that of *Stereodon cupressiformis* var. *filiformis*. The subula of the leaf is usually entire, but may be faintly denticulate. The seta is constantly short, almost always slightly under 1 cm.; it is for the group somewhat stout, and is always more or less roughened at the apex, though this may at times be very inconspicuous. The capsule resembles that of *R. amoenum*, but has, probably constantly, the base markedly enlarged with a narrow ring, and passes abruptly below this into the seta. The perichaetial bracts are erect, with an acuminate-subulate acumen which is sharply denticulate. For the differences from *R. Dallii* and *R. acutifolium* see below.

It is, I believe, a rare species in New Zealand.

3. **Rhaphidostegium Dallii** Broth. & Geh. in Oefv. af. Finska Vet.-Soc. Foerh. xlii, 115 (1900).

Dr. Brotherus has kindly sent me a specimen of this; but as it was without fruit, I am dependent on the description for the fruiting characters. Vegetatively it agrees exactly with *R. leucocytus*, but the seta is described as "tenuis, laevissima"; the inflorescence is autoicous, and the perichaetial leaves "integerrimae"; characters which if constant are amply sufficient to constitute a distinct species.

It has not, I believe, been found since its first gathering by Dall, the locality not being given.

4. **Rhaphidostegium acutifolium** (H. f. & W.) Dixon comb. nov.

Syn. *Hypnum acutifolium* H. f. & W. in Lond. Journ. Bot. iii, 553 (1844); Fl. Antarct. i, 138 (1847); Handb. N.Z. Fl., p. 476. *Rhynchostegium acutifolium* Jaeg. Adumbr, ii, 442.

This was described from a sterile plant collected in Campbell's I. by Hooker. I have examined the type, and there is no question whatever of its being a Rhaphidostegium closely allied to *R. leucocytus*. It is indeed doubtful if it be actually distinct, but in the absence of fruit, which might throw light on the problem, it is better retained as a separate species. It differs from that only in the leaves quite straight and erect, or only extremely faintly falcate at the cuspidate tips of the branches, not at all glossy, and in their form: in *R. leucocytus* they taper gradually from just above the base to a long, flexuose subula which is as long as the leaf base—if it is possible to delimit this; in the present species the leaf base is oblong-lanceolate, and narrows rather abruptly into a slightly oblique, much less flexuose, almost strict subula, usually much shorter than the leaf base. No flowers or fruit were found; and the plant has not been found since.

It is clear that C. Mueller and Jaeger have treated as *Hyp. acutifolium* what is obviously a quite different thing; for one thing, they are dealing with a uninerved species; and as described by C. Mueller an entirely different plant. This is due to a mixture of plants; the British Museum specimen consists indeed almost entirely of a moss which is no doubt the original of C. Mueller's description—it might well be a small form of *Brachythecium rutabulum*.

5. **Rhaphidostegium contiguum** (H. f. & W.) Par. Ind., p. 1090.

Syn. *Hypnum contiguum* H. f. & W., Fl. Tasm., ii, 213 (1860). *H. crassiusculum* Fl. N.Z. ii, 113, et Handb. N.Z. Fl., p. 474; vix *H. crassiusculum* Brid.? *H. Kirkii* C. M. & Beck. in Trans. N.Z. Inst. xxv, 294 (1892). *Rhaphidostegium Kirkii* Broth. in Engler & Prantl, Pflanzenfam., Musci, ii, 1110.

Distinguished at once from the succeeding plants by the very pale, whitish colour, the delicate, narrow, finely acuminate leaves; from all the preceding (except *R. acutifolium*) by the leaves being straight or very slightly curved, often secund and pointing upwards, very concave, entire; the very short seta, not much more than .5 cm., thin, and smooth; and the very small capsule, which is elliptic, very slightly asymmetric with a very short, narrow neck, never thickened as in the preceding plants. The capsule varies much in form and direction. *R. acutifolium* differs in the leaves not at all secund or ascending, less concave, and not at all whitish in colour.

It appears to be fairly frequent in New Zealand and has a rather wide distribution in Oceania and Australasia.

It is doubtful whether it is identical with *R. crassiusculum* (Brid.)

I have not seen an original specimen of *H. Kirkii* C. M. & Beck., but the description does not suggest any difference from *R. contiguum*, and a specimen of Beckett's own collecting and naming (Moreton Bush, Tai Tapu, Canterbury. No. 370e) is certainly this species.

6. **Rhaphidostegium tenuirostre** (Hook.) Jaeg. Adumbr. ii, 469.

Syn. *Hypnum tenuirostre* Hook. Musc. Exot. t. 111 (Feb. 1819): Fl. N.Z. ii, 113; Handb. N.Z. Fl., p. 474.

This and the following two species are much more robust than any of the preceding, and are not likely to be mistaken for them, though small sterile forms of the present plant might pass for robust forms of *R. amoenum* or *R. leucocytus*. The leaves however are larger, the acumen much shorter and less filiform, often quite broadly loriform; the alar cells are frequently if not always more numerous and conspicuous; the seta is longer, from about 1.5 to 2 cm., the capsule usually subhorizontal, rather large, the perichaetial leaves numerous, widely and shortly pointed, scarcely acuminate, entire or nearly so. The branches are usually, but not quite always, markedly cuspidate at apex. The foliation is generally very dense. The leaves are sometimes finely but sharply denticulate at apex.

It appears to be uncommon.

7. **Rhaphidostegium Jolliffii** (Mitt.) Jaeg. Adumbr. ii, 457.

Syn. *Stereodon Jolliffii* Mitt. in Journ. Linn. Soc., Bot., iv, 87 (1859). *Hypnum Jolliffii* Hook. f., Handb. N.Z. Fl., p. 474.

A robust plant, somewhat resembling the last, but with much shorter, widely oval, acute but not acuminate leaves, usually secund, but not falcate; the perichaetial leaves very similar to those of the last; the seta shorter, and slightly rugulose at apex, the capsule shorter, and subhorizontal. It is, as Mitten says, very near to *R. loxense* (Hook.), i.e., *R. caespitosum* (Sw.), but the seta seems constantly roughened above.

It is, I think, rare, especially in the South I.

8. **Rhaphidostegium homomallum** (Hampe) Jaeg. Adumbr. ii, 749.

Syn. *Leskea homomalla* Hampe Ic. Musc., t. 6 (1844); *Hypnum homomallum* C. M. Syn. ii, 336; Handb. N.Z. Fl., p. 474.

Very similar indeed in habit and leaf form to the last, but dioicous, and with very distinct alar cells; instead of having 1-3 large, pale, vesicular cells side by side at the basal angles with a few much smaller but short and wide ones above, as usual in this genus, the alar cells are numerous, orange, all highly incrassate, and the extreme alar ones only a little longer and not much differentiated from the rest (cf. Brotherus, Musci, fig. 789). The capsule also is suberect.

R. homomallum is a rare species, and has not, I believe, been found in the South I.

AMBLYSTEGIACEAE.

Stems irregularly or pinnately branched. Leaves arranged all round the stem, or falcate, not complanate. Nerve single (in Acrocladium very short, sometimes double or even wanting). Capsule nearly always curved, often arcuate; lid conical, often mamillate, not beaked. Seta smooth. Mostly moisture-loving plants, frequently semi-aquatic.

KEY TO GENERA.

1	Upper cells short (3-4 × 1), often parenchymatous	*Amblystegium*
	Upper cells long and narrow, prosenchymatous	2
2	Leaves with a differentiated border (often faint)	*Sciaromium*
	Leaves unbordered	3
3	Leaves obtuse or shortly and widely pointed	4
	Leaves acuminate	5
4	Nerve very short or none	*Acrocladium*
	Nerve reaching to near apex, leaves elliptic-oblong, obtuse or apiculate	*Calliergon*
5	Leaves more or less falcate-secund	*Drepanocladus*
	Leaves spreading in all directions, often squarrose	*Campylium*

AMBLYSTEGIUM Bry. eur., fasc. 55-56 (1853).

The New Zealand species are known by the smooth, often short and rhomboid-hexagonal upper cells, together with the short, obtuse lid.

1	Leaves large, 2.5 mm. long, or more, cells 8-15 times as long as broad	2. *riparium*
	Leaves smaller, 1.5 mm. long, or less, cells 4-6 times as long as broad	2
2	Autoicous; stems irregularly branched; leaves straight, alar cells small, subquadrate	1. *serpens*
	Dioicous; stems more or less pinnate; leaves falcate-secund, distinctly auricled at base, with enlarged alar cells	3. *filicinum*

1. **Amblystegium serpens** (L.) Bry. eur., loc cit.

Syn. *Hypnum serpens* Linn. Sp. Pl., p. 1130.

A slender, dark green moss, with filiform stems and branches, and minute leaves, which are variable in form, but more or less ovate-lanceolate or lanceolate, entire or denticulate, with a single, usually short nerve, and short areolation, having a group of small, subquadrate cells above the base at margin, but except in form hardly different from the adjacent cells, and quite without enlarged decurrent alar cells.

I have not seen the typical form from New Zealand. The plants referred to *Hypnum serpens* var. *β*. in the Handbook belong to *A. filicinum* var. *trichodes*. Colenso's plant from Hawkes Bay is a sterile, more robust moss than the usual forms, with long, rather divergent, longly acuminate leaves and long nerve, coming very close to some European and North American plants usually referred to *A. Juratzkanum* Schimp. It is a plant that requires further study.

2. **Amblystegium riparium** (L.) Bry. eur. fasc. 55-56 (1853).
Syn. *Hypnum riparium* Linn. Sp. Pl. p. 1129 (1753).

A much larger plant than either of the other species, usually more or less aquatic, with soft, irregular, straggling, more or less complanate branches, the leaves rather widely divergent, 2.5 to 3.5 mm. long, of a rather dull, olive green, the older ones often very dark, from a short, decurrent, ovate base elongate lanceolate, finely subulate, quite entire; nerve reaching to about two-thirds the length of the leaf. Cells narrow and elongate, linear (Hypnoid), 8-12 times as long as wide or even longer, becoming gradually laxer towards base, but not forming distinct auricles or with any clearly differentiated alar cells.

Autoicous. Seta short; capsule curved.

A. riparium is mentioned in the Fl. N.Z. ii, 109, and in Handb. N.Z. Fl., p. 482, as recorded from Hawkes Bay, but with some degree of doubt. It has not since been recorded, but I have received it from three stations, all in the North I., and its presence in New Zealand is clearly established. The localities are as follows:—By a creek, Hunterville, Marton, coll. Chas. J. Burgess, two specimens, 26 and 26a, the latter in fruit, the former an aquatic, floating form with large, spreading leaves; Rotorua, Tarawera, coll. Berggren (2575); and North Auckland, coll. H. B. Matthews, comm. G. O. K. Sainsbury (No. 209), this latter a similar form to No. 26 mentioned above.

A. riparium is very different from the other two species, and in some respects is out of place in the genus, the cells being not at all "Amblystegioid." It is most likely to be confused with *Drepanocladus aduncus*, and some forms of that cannot be separated without microscopical examination. The very clearly defined auricles of the Drepanocladus, however, will always distinguish it.

3. **Amblystegium filicinum** (L.) De Not., Cronaca, ii, 25 (1867).
Syn. *Hypnum filicinum* Linn., Sp. Pl., p. 1125; Handb. N.Z. Fl., p. 472. *Hygroamblystegium filicinum* Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1028.

The typical plant is a fairly robust one, with more or less erect, radiculose stems, shortly pinnately branched; it varies, however, so greatly that this habit cannot be depended upon — all the New Zealand plants I have seen are more or less aquatic, or very slender forms resembling the last species. In the typical form it is easily known by the stout nerve, often percurrent or excurrent, the short and wide cells, and the decurrent group of larger, pellucid or orange alar cells. In the very slender forms these characters tend to disappear, and it is then very difficult to distinguish from *A. serpens*, which however is autoicous and generally fertile, while the present dioicous plant is rarely found in fruit. *A. serpens* also is usually green, while the small forms of the present species tend to an olive or orange-brown. All the plants recorded from the Aucklands as *Hypnum serpens* var. *β.*, belong to these forms, and are referable to the var. *trichodes.*

Var. trichodes (Brid.) (*H. trichodes* Brid. Sp. M. ii, 236). Extremely slender, filiform, with minute leaves; scarcely distinguishable from *A. serpens* except by the shorter cells and distinctly stouter nerve, reaching higher in the leaf.

The Handbook records *A. filicinum* only from the Aucklands; I have it however from Hawkes Bay, Rotorua and Taupo, in the North Island, and from an unnamed locality in the South I., the last three gatherings being by Berggren.

SCIAROMIUM Mitt. Musc. Austr.-amer., in Journ. Linn Soc., Bot., xii, 571 (1869).

A genus of aquatic, almost always sterile mosses, distinguished by the very stout nerve, and more or less differentiated, often thickened border. In the New Zealand species the border is weak and may at times be easily overlooked, but in some leaves at least it will be found well marked.

Sciaromium Bellii Broth. in Oefv. af Finska Vet.-Soc. Foerh. xl, 189 (1898).

Plants floating in water, bright or dull green, up to 9 cm. in length, more or less flexuose and flaccid, much branched. Leaves spreading in all directions or very slightly homomallous, 2 mm. long or rather more, cordate-ovate, abruptly acuminate and acute; nerve very stout, usually reaching to or nearly to apex, sometimes becoming confluent with the border and slightly excurrent; cells very narrow, 3-4 rows at margin with more incrassate, brownish walls, so as to form a border, which however is not thickened and may be inconspicuous; entire or faintly sinuose or irregular; basal cells slightly widened at angles but very little differentiated. Dioicous. Fruit unknown.

Hab. South I., N.E. Valley, and Southland (W. Bell); Otago (T. W. N. Beckett); North I., Otaua (S. Berggren, 2770).

Brotherus describes the leaves as "minutissime denticulatis," but if technically correct this description is I think rather misleading, as most of the leaves are quite entire, and the denticulations when present scarcely amount to more than a slight sinuosity.

The stout nerve, the short and wide, not or scarcely falcate leaves, and the presence of a border, will separate it at once from others of the Amblystegiaceae. The only plants likely to be confused with it are certain aquatic forms of the Hypnodendraceae, viz., *Sciadocladus Kerrii* and *Hypnodendron marginatum*; both of these have narrower, ovate-lanceolate leaves, a much narrower nerve, shorter and wider cells, and a distinctly toothed margin.

I have not been able to see the plant referred to by Brotherus (loc. cit.) as gathered by Beckett (No. 609) at Tyson's Mill, Otago, possibly differing from *S. Bellii.*

DREPANOCLADUS (C. M. as Subsect. of Hypnum) Roth in Hedwig. xxxviii, Beiblatt, p. 6 (1899). (Hypnum Sect. Harpidium Sull., et plur. auct.)

A genus of hygrophilous or aquatic mosses, which while small in point of species, is probably responsible for as large a number of individuals as almost any group of mosses, several of the species being very widely distributed, and nearly all being extremely plastic. (Paris has more than two pages of the varieties of *H. fluitans* alone!) The arrangement of the forms of the northern hemisphere have given rise to much controversy. In New Zealand, however, fortunately for the student, they do not seem, with the exception of *D. fluitans*, particularly common or variable.

KEY.

1	Leaves distinctly plicate	1. *uncinatus*
	Leaves not or very faintly plicate	2
2	Leaves straight; habit of a very slender Fontinalis	5. *fontinaliopsis*
	Leaves more or less falcate	3
3	Alar cells few, often not at all clearly defined	2. *brachiatus*
	Alar cells numerous, clearly defined	4
4	Leaves sub-deltoid at base, rather shortly subulate	3. *aduncus*
	Leaf base narrow, oblong, acumen long and tapering	4. *fluitans*

1. **Drepanocladus uncinatus** (Hedw.) Warnst. in Beih. z. Bot. Centralbl. xiii, 417 (1903).

Syn. *Hypnum uncinatum* Hedw. Descr. iv, 65; Fl. N.Z. ii, 107; Handb. N.Z. Fl., p. 472. *Hypnum aduncum* Linn. Sp. Pl., *non* Hedw.

The typical form is readily known by its strongly falcate, deeply plicate leaves, with rather numerous but quite small alar cells; the autoicous inflorescence, and the extremely long, plicate perichaetial leaves. A small form, perhaps var. *plumulosus* (Bry. eur.) occurs, in very dense tufts, with very small, scarcely plicate leaves; and this may be difficult to recognize; the absence of enlarged alar cells will however distinguish it from all but *D. brachiatus*, which is much taller and of a quite different habit.

It might easily be confused with *Brachythecium paradoxum*, but the serrulate, less gradually tapering leaf acumen of that species, with the more gradually widened base and alar cells, will distinguish it. In fruit they are quite distinct; the perichaetia and capsule in *D. uncinatus* being much narrower and longer, and the seta smooth.

It appears to be rare in New Zealand. In the northern hemisphere and especially in the arctic regions it is one of the most abundant mosses.

2. **Drepanocladus brachiatus** (Mitt.) Dixon comb. nov.

Syn. *Hypnum brachiatum* Mitt. in Hook. f. Handb. N.Z. Fl. p. 472 (1867). *H. longifolium* Wils. MS. *Amblystegium longifolium* Mitt. Musc. Austr.-amer., in Journ. Linn. Soc., Bot., xii, 571 (1869). *Drepanocladus longifolius* R. S. Williams in Bull. Torr. Bot. Cl. 43: 332 (1916),

This species is easily confused with *D. fluitans*, and can hardly perhaps in the field be separated with certainty. *D. fluitans* is autoicous, and generally fruits richly, while the present species is dioicous and very rare in fruit; the leaves are usually more strongly falcate in the present species, and slightly striate when dry. Under the microscope the leaf-base is quite different, *D. fluitans* having strongly marked decurrent alar cells, which are large and more or less inflated; the basal cells in the present species are all slightly, but not much laxer, but there are not or rarely any decidedly enlarged hyaline alar cells, and if present they are only one or two, and these not large, forming a quite small group. Within certain limits, however, the leaves vary greatly, the base being especially wide and ovate, the alar cells may be fairly numerous or altogether wanting, while the nerve is distinctly variable, both in length and thickness, sometimes scarcely reaching to mid-leaf, sometimes almost or quite percurrent. The leaves in *D. brachiatus* are quite entire, while in *D. fluitans* they are frequently remotely denticulate in the acumen. In the present species they are often very lightly striate in the dry state; but they lack the plication of *D. uncinatus*, and also the clearly defined group of small, numerous alar cells.

It apears to be widely distributed, but perhaps not very common.

There can be no doubt of the identity of *H. brachiatum* Mitt. and *H. longifolium* Wils. I have a fairly long series of the latter plant, from the Falkland Is., S. Shetlands, and Patagonia, including a fruiting plant collected on Chiloe I., by Mr. J. Hamilton—the first fruiting specimen that has been collected, so far as I am aware. These plants agree quite well with the New Zealand moss, and manifest the same variations in habit, leaf form, and structure of nerve and areolation; while the fruiting characters are identical, the long, erect, broadly lanceolate, rather shortly but finely acuminate perichaetial leaves being the same in both, and the rather elongate, suberect, little curved capsule, while a still more distinct character is given by the lid. In most species of the genus the lid is rather highly conical, the height being about equal to or above the width of the base; in the two fruiting plants I possess of *D. brachiatus*, one from New Zealand, the other from Chiloe I., the point of the lid is very small, and the width of the lid is considerably greater than its height.

It is unfortunate that Wilson's name must give place to Mitten's, published two years earlier, since the former has been in frequent use, while the earlier name has, so far as I am aware, been very little employed since its publication, having been, in some way or other, omitted from both editions of Brotherus, Musci.

The distribution of *D. brachiatus* is very similar to that of a large number of species, viz., Australia, Tasmania, New Zealand, S. Shetlands, Falklands, Patagonia, Peru.

3. **Drepanocladus aduncus** (Hedw.) Moenk. in Pasch. Suesswass.-Fl., Heft 14, p. 132 (1914).

Syn. *Hypnum aduncum* Hedw. Descr. p. 62 (*non* Linn.). *H. Kneiffii* Schimp., Fl. N.Z. ii, 107; Handb. N.Z. Fl., p. 472.

More slender as a rule than *D. fluitans*, rarely fruiting, greener; leaves less crowded, shorter, from a rather wide, deltoid base rapidly narrowed to a shorter and wider, quite entire acumen. The lower cells are somewhat lax, and the alar cells are generally rather abruptly enlarged, lax, thin-walled, and hyaline, forming clearly marked auricles, and strongly decurrent, so that the line of insertion, when a leaf is carefully detached is more or less semicircular, whereas in *D. fluitans* it is almost straight or only slightly curved. The leaves vary much in direction, being strongly falcate with the apex of the stem hooked, or almost straight, with the leaf acumen only slightly oblique, and the tips of the stems quite straight. It is also usually a much weaker, more straggling plant than *D. fluitans*, with less markedly pinnate branching.

A specimen from L. Wakatipu, leg. J. Meiklejohn, was named by Renauld (in a letter to Rev. D. Lillie) "var. nov. *circinnatulus* Ren." It is marked by strongly falcate, almost circinate leaves, and strongly hooked stems. I have received an even more strongly marked form of this variety from Wairoa, Hawkes Bay, collected by E. A. Hodgson.

D. aduncus is I think a rare or perhaps overlooked species.

4. **Drepanocladus fluitans** (L.) Warnst. in Beibl. zu Bot. Centralbl. xiii, 404 (1903).

Syn. *Hypnum fluitans* Linn., Fl. Suec. ed. 2, p. 899; Handb. N.Z. Fl., p. 472.

Generally yellowish-green when not submerged, but very varied in all directions. Distinguished by its very long and narrow leaves, oblong-lanceolate below, and often piliform in the acumen, which is frequently slightly toothed; more or less falcate, or when dry variously flexuose; the nerve usually strong and reaching into the acumen; the upper cells very narrow, and little enlarged to the base, but with a more or less distinct group of slightly decurrent, highly differentiated alar cells, elongate and more or less incrassate, sometimes very much so.

A sterile plant from near Invercargill, 1908, leg. J. Meiklejohn, herb. D. Lillie, was determined as "sub-spec. nov. *Drep. Lilliei* Ren. in litt. 1 June, 1909." It has never been published, but is referred to by G. Roth in Hedwig. 1, 113 (1910). According to Roth it is marked by large, almost orbicular auricles; but I find only an approach to this in some leaves, while in most the auricles are quite normal, and I am unable to see anything but a slight form in it.

D. fluitans is a common marsh plant, and exceedingly variable.

5. **Drepanocladus fontinaliopsis** (C.M.) Dixon comb. nov. [Plate X, fig. 17.]

Syn. *Hypnum fontinaliopsis* C.M. in Engl. Bot. Jahrb. v, 82 (1884).

This a very marked, and as the genus goes an apparently fairly constant species. Its alliance is no doubt with *D. fluitans*, but in habit and structure it differs widely; it has rather long, fastigiate branches, with leaves not at all falcate, and resembles very strongly some of the more slender species of Fontinalis. The leaves resemble those of *D. fluitans*, but are much shorter and wider in the points; the nerve is short, and the alar cells are scarcely at all differentiated. In two respects the plant differs from the original as described by C. Mueller: the leaf apex is sharply denticulate (instead of slightly crenulate), and the nerve is usually very weak (C. Mueller's description is "pro folio latiusculo"), but these slight differences can scarcely be considered of importance in this genus.

It was collected by Berggren in 1874, "Rotorua, Tarawera" (2577), and "Tamauga" (2786); both in the North I. It has hitherto only been known from Kerguelen.

CALLIERGON (Sull.) Kindb. Eur. & North Amer. Bryin. i, 79 (1896).

(Hypnum, subgen. Calliergon Sull.)

Marsh plants with erect, not falcate nor secund leaves, concave, rounded and obtuse above, single-nerved, with distinctly marked auricles.

Calliergon sarmentosum (Wahl.) Kindb., op. cit., p. 81.

Syn. *Hypnum sarmentosum* Wahl., Fl. Lapp. p. 380 (1812).
Amblystegium sarmentosum De Not. Epil., p. 136.

Known in its typical form by the deep claret-red or purplish colour, but this is occasionally wanting, while in habit, size and arrangement of leaves it is exceedingly variable. The elliptic-oblong, entire leaves, rounded and obtuse or very slightly apiculate, with the nerve reaching to the apex; the very narrow cells with well defined, orange or hyaline decurrent auricles, will however distinguish it from all other New Zealand species.

It is a rare moss, having been recorded for the first time in 1896 (as *Amblystegium sarmentosum*), in Trans. N.Z. Inst. xxix, from Kellys Hill, Westland (leg. Petrie). I have seen no further record, but I have it in my herbarium also from Craigieburn Mts., Canterbury (leg. Cockayne); a large, soft, aquatic form, not far removed from var. *fontinaloides* Berggr.

ACROCLADIUM Mitt. Musc. Austr.-amer. in Journ. Linn. Soc., Bot., xii, pp. 22, 531 (1869).

A genus very imperfectly defined by Mitten, since he describes it as belonging to the tribe Stereodonteae, with leaves shortly two-nerved or nerveless, and with alar cells obscure or none; while *A. auriculatum*, which should be considered the type species, has a short single nerve, and auricles perhaps as conspicuous and clearly differentiated as in any pleurocarpous moss known! I can see no adequate ground for removing it from the Hypnaceae and placing it with Lembophyllum; indeed it would appear to me quite as satisfactory to unite it with Calliergon in a single genus.

KEY.

Leaves about twice as long as wide, nerveless; dioicous	2. *cuspidatum*
Leaves almost as broad as long; nerve single, very short; autoicous	1. *auriculatum*

1. **Acrocladium auriculatum** (Mont.) Mitt. op. cit., p. 532 (1869).

Syn. *Hypnum auriculatum* Mont. Voy. au Pôle Sud; Crypt., p. 331 (1843). *Hypnum chlamydophyllum* H. f. & W., in Lond. Journ. Bot. iii, 552 (1844); Fl. N.Z. ii, 111; Handb. N.Z. Fl., p. 481.

Hooker in the Handbook, and Mitten in the Musci Austro-americani recognized the identity of *H. chlamydophyllum* with *H. auriculatum*, though the former author wrongly retained the later name. It is quite incomprehensible why later authors (e.g., Brotherus in Engler & Prantl, Musci, Ed. i & ii) have retained the two, distinguishing *H. chlamydophyllum* as having the leaves without auricles, whereas it is described by its authors as having them auricled. The South American plant and the New Zealand one are as a matter of fact absolutely identical. The species is known at once by the very broad ("orbicular-quadrate" is the description in the Handbook), obtusely rounded, concave leaves, with highly conspicuous auricles of large, thin-walled, hyaline cells, and a very short and inconspicuous nerve, which may be quite wanting.

A. cuspidatum has leaves much narrower at the base, and much longer in proportion; the capsule is more turgid, but is rarely seen. Both species have the tips of stem and branches highly cuspidate with the closely convolute young leaves. Both are usually of a yellowish colour, glossy, with long, distinctly pinnate stems.

A. auriculatum is a common species on moist ground.

2. **Acrocladium cuspidatum** (L.) Lindb. Musc. Scand. p. 39 (1879).

Syn. *Hypnum cuspidatum* Linn. Sp. Pl., p. 1127.

Known at once by the convolute, cuspidate points of the stem and branches, and its cordate-ovate, obtuse, nerveless leaves, with large, distinctly marked auricles; and from the previous species by the taller habit, more rigid stems, and much more elongate leaves.

Its position as a New Zealand moss rests on a specimen "Pelichet Bay, Otago, May 1888, in herb. Bell." det. Brotherus. See Trans. N.Z. Inst., xxix, 445.

CAMPYLIUM (Sull.) Bryhn Explor. p. 61 (1893). (Hypnum *Subgenus* Campylium Sull.)

A rather ill defined genus of moisture-loving species, but generally characterized by longly pointed, stellately spreading or squarrose leaves, with very narrow areolation.

KEY.

1	Nerve thin, leaves widely patent, not squarrose; cells elongate, Hypnoid	1. *polygamum*
	Nerve broader, leaves more or less squarrose; cells short, Amblystegioid	2
2	Robust, leaves mostly horizontally spreading, often secund; nerve stout, reaching often into acumen	2. *relaxum*
	Slender; leaves strongly recurved; nerve thin, much shorter	3. *decussatum*

1. **Campylium polygamum** (Bry. eur.) Bryhn, Explor., p. 61 (1893).

Syn. *Amblystegium polygamum* Bry. eur., vol. vi (1853). *Hypnum polygamum* Schimp. Coroll. p. 131 (1856); Handb. N.Z. Fl., p. 479. *Hypnum nodiflorum* Wils. in Fl. N.Z. ii, 109.

A variable plant in size, in the direction of the leaves, and in the development of the nerve, which may be very short. The plants are usually of a golden yellowish colour, somewhat glossy, and usually fertile. It is not likely to be confused with any other plant. The leaves are quite entire, and the finely acuminate subula is more or less channelled, by which it may be distinguished from *Drepanocladus aduncus,* and *Amblystegium riparium.*

C. polygamum appears to be widely distributed, but not common.

The two following plants are in quite a different Section, and Fleischer may perhaps be justified in placing them in a separate genus (Cratoneuropsis). They have the stems strongly radiculose below, and more or less clothed with paraphyllia above; the leaves are decidedly squarrose, with short, Amblystegioid cells, wider, but often ill defined nerve, and the margins usually serrulate. The inflorescence is dioicous.

2. **Campylium relaxum** (H. f. & W.) Broth. in Engler & Prantl, Pflanzenfam., Musci, ii, 1044 (1908).

Syn. *Hypnum relaxum* H. f. & W., Fl. N.Z. ii, 110 (1855); Handb. N.Z. Fl., p. 479.

This and the following species are very distinct from all other New Zealand mosses, but are by no means always easy to separate from one another. Typically the present is much more robust, the leaves spreading at right angles to the stem, but very little recurved beyond this, and frequently irregularly secund; the margin is nearly entire, the nerve thicker and often continued to the acumen or even percurrent, the cells more opaque; while *C. decussatum* is a much more slender plant, with much smaller and denser leaves, very regularly and strongly squarrose-recurved all round the stem, the nerve weaker and much shorter, often reaching scarcely half-way; the cells more pellucid, and the margin usually finely, but quite distinctly serrulate. There are, however, forms which it is very difficult to assign. *C. relaxum* is usually of laxer growth, and distant, more irregular branching, *C. decussatum* more densely pinnately branched; but this is not constant.

An extremely slender form occurs which might be derived from either species, or possibly parallel forms of both exist, the leaf characters being to some extent intermediate; I have these forms from three localities, two at least bearing ♂ flowers; it is possible that the slender habit may be a secondary sexual character of the male plant. It may be this plant which has been described by Brotherus from Tasmania as *C. molle* (ined.).

C. relaxum is confined to New Zealand, where it apears to be fairly frequent.

3. **Campylium decussatum** (H. f. & W.) Brotherus in Engler & Prantl, Pflanzenfam., Musci, ii, 1044 (1908).

Syn. *Hypnum decussatum* H. f. & W., Fl. N.Z. ii, 110 (1855); Handb. N.Z. Fl., p. 480.

For the characters of this plant see the preceding species. The fruit has not been seen. It is a very pretty moss in its regular, recurved foliation. With a somewhat wider general distribution, it seems rather less frequent in New Zealand than *C. relaxum*.

BRACHYTHECIACEAE.

Mostly fairly robust, terrestrial plants, with irregular, not pinnate branching. Leaves imbricated all round the stem, rarely either complanate or falcate or secund; usually acute or acuminate from a broader base. Nerve single. Cells prosenchymatous, smooth, usually elongate and narrow, frequently somewhat differentiated at angles. Seta rough or smooth. Capsule usually of moderately large size, generally rather turgidly oval and gibbous; lid conical or longly rostrate.

Key to Genera.

(The Key is drawn up only with reference to the New Zealand species.)

1	Lid conical, usually acute	*Brachythecium*
	Lid rostrate, with a long beak	2
2	Seta smooth	*Rhynchostegium*
	Seta rough	*Eurhynchium*

Brachythecium Bry. eur., vol. vi, fasc. 52-54 (1853).

The characters of this and the following genera are hard to define, and indeed apart from the character of the lid are very indefinite. There is, however, a certain habit by which they may generally though not always be recognized, the species of Brachythecium being generally coarser and more robust and rigid, with denser branching; those of Rhynchostegium more slender and flaccid, vaguely branched, with leaves more distant and with a tendency to be complanate; while that of Eurhynchium is somewhat between the two. The fruit is, if not absolutely necessary, of paramount assistance in determining the plants, and beginners should not attempt to determine them without fruit, until the general habit is understood. The conical, more or less acute lid is the main character of Brachythecium.

KEY.

1	Leaves falcate, striate	4. *paradoxum*
	Leaves not falcate (in *B. plumosum* sometimes slightly so)	2
2	Seta smooth, leaves longly acuminate	1. *salebrosum*
	Seta smooth below, roughish above; leaves shortly acuminate	3. *plumosum*
	Seta rough throughout; leaves large, shortly acuminate	2. *rutabulum*

1. **Brachythecium salebrosum** (Hoffm.) Bry. eur., loc. cit. (1853).

Syn. *Hypnum salebrosum* Hoffm. Deutschl. Fl. ii, 74 (1796).

Easily known by its pale, usually yellowish, silky stems, with soft, very plicate leaves, generally tapering gradually to a long subpiliform subula; by the autoicous inflorescence and quite smooth seta.

I do not find any published record, but I have half a dozen New Zealand specimens in my herbarium, from both North and South Islands, as well as one from Stewart I.

A plant from Beckett's herbarium is determined by Brotherus as nov. var. *integrifolium*. But in view of the great number of varieties already described (Paris lists 14), and of the fact that the northern plant frequently has the leaves entire (cf. Limpr., Laubm. iii, 74), it does not appear to me desirable to publish it as new.

B. salebrosum is a widely distributed plant in the northern hemisphere, and occurs in Tasmania, Kerguelen, and S. Africa.

2. **Brachythecium rutabulum** (L.) Bry. eur., loc. cit.

Syn. *Hypnum rutabulum* Linn. Sp. Pl., p. 1124; Fl. N.Z. ii, 109; Handb. N.Z. Fl., p. 478.

Known at once when in fruit from *B. salebrosum* by the rough seta; and in the sterile condition, by the broader, more shortly pointed leaves, never filiform and acuminate, not or rarely very slightly plicate, and then only when dry. It varies considerably in habit, but is nearly always a quite robust, strong-growing plant. Although usually quite distinct from *B. salebrosum*, forms occur occasionally that can scarcely be determined with safety without fruit. The cells in this species are linear-rhomboid, and are markedly wider, lax and pellucid at the angles.

Var. robustum Bry. eur. More robust than the type; leaves large, distinctly plicate when dry.

B. rutabulum, one of the most common mosses in the temperate parts of northern Europe and America, is apparently fairly frequent, but not abundant in New Zealand. I have the var. *robustum* from Mt. Cook district, coll. Jas. Murray (124). Although the plicate leaves might suggest a difficulty in separating it from *B. salebrosum*, this is not actually the case, since the var. is a much coarser plant, with none of the silkiness that generally characterizes *B. salebrosum*.

3. **Brachythecium plumosum** (Sw.) Bry. eur. loc cit.

Syn. *Hypnum plumosum* Sw. in Act. Holm., 1795, p. 256; Fl. N.Z. ii, 109; Handb. N.Z. Fl., p. 479.

Known from *B. rutabulum* by the smaller, less cordate, more elliptic leaves, shortly and rather suddenly acuminate, the branch leaves often acute only; by the short seta, roughish above only, the short, usually blackish capsule; the upper cells very narrow, and while enlarged at base not lax and pellucid. *B. rutabulum* moreover is almost constantly terrestrial, while *B. plumosum* is mostly found on rocks in alpine and subalpine streams. A form occurs with the leaves all strongly and regularly homomallous, occasionally also slightly falcate.

4. **Brachythecium paradoxum** (H. f. & W.) Jaeg. Adumbr. ii. 495 (1875-6).

Syn. *Hypnum paradoxum* H. f. & W. in Lond. Journ. Bot. iii, 554 (1844); Handb. N.Z. Fl., p. 479.

This very remarkable species is in habit, with its strongly falcate, plicate leaves, exactly like some of the species of Drepanocladus, especially *D. uncinatus,* and is classed by C. Mueller, in the Synopsis, with these species. The scabrous seta is, however, quite inconsistent with that arrangement, and it seems clearly to belong in Brachythecium; in this connection it may be noted that North American forms of *B. flexicaule* Ren. & Card., and of *Camptothecium nitens,* occur with the leaves strongly falcate. The strongly serrulate acumen of the leaves will distinguish it from the species of Drepanocladus, as a rule, but forms of the present plant occur with the leaves almost entire; in that case the areolation will separate it; the alar cells are numerous and enlarged, but pass gradually with median ones into the narrow upper areolation; in *D. uncinatus,* which has them similarly enlarged, they are clearly differentiated from the upper cells, which remain narrow almost to the base, and are abruptly enlarged at angles. *D. fluitans* has much narrower leaves at base, and the alar cells are abruptly enlarged. *D. aduncus* has non-plicate leaves, and the cells are not gradually laxer towards base. *D. brachiatus* has the alar cells scarcely wider than the rest of the basal ones, and the leaves are not plicate—at the most very faintly striate.

Campylium relaxum in its falcate-leaved form may resemble it, but the very short upper cells are quite different.

B. paradoxum is a widely distributed, if perhaps rather uncommon moss in bogs, and is extremely variable; some of the forms are exceedingly slender; and in Kerguelen it produces forms which are with difficulty recognized as belonging to the same species as the normal ones.

EURHYNCHIUM Bry. eur. vol. v, fasc. 57-61 (1854).

I treat this genus very much as delimited in the Bry. europaea, i.e., retaining in it the species removed by recent authors to Oxyrrhynchium, Scorpiurium, Cirriphyllum, etc.

The four New Zealand species here included in Eurhynchium, while quite distinct from one another, are far from easy to define. If the descriptions in the Handbook are studied it will be found that the only characters given which are of the least assistance are the short seta of *H. muriculatum* (the description of the seta of *H. austrinum* as ½ inch is inaccurate); and the longer branches of *H. austrinum* (the inflorescence of *H. remotifolium* is given as hermaphrodite, but the New Zealand species is autoicous).

KEY.

1	**Leaves markedly dimorphous; stem leaves widely cordate, branch leaves lanceolate, narrow**	**4.** ***praelongum***
	Leaves not markedly dimorphous	**2**
2	**Branches long, ½-1 in. in length; plant robust, dark green**	**2.** ***austrinum***
	Branches shorter, plant usually pale or dull green	**3**
3	**Seta rarely over 1 cm.**	**1.** ***muriculatum***
	Seta rarely below 1 cm., usually 1.5-2 cm.	**3.** ***asperipes***

The above key will I think serve to distingush the plants in nearly every case, but it is of course quite artificial, and the only satisfactory plan is to have a close knowledge of certain minor and not easily defined characters. It is probably unsafe to determine most sterile plants, not only because of their resemblance to one another, but also because some of the species of Rhynchostegium are equally hard to separate from them in the absence of fruit.

1. **Eurhynchium muriculatum** (H. f. & W.) Jaeg. Adumbr. ii, 417 (1876-77).

Syn. *Hypnum muriculatum* H. f. & W., Fl. N.Z. ii, 108 (1855); Handb. N. Z. Fl., p. 477.

The smallest species of the genus in New Zealand. Usually of a dull green, in dense tufts or patches, closely interwoven; stems more or less pinnately, shortly branched, branches rarely attaining 1 cm. in length. Leaves small, about 1 mm. in length, narrowly ovate or elliptic-lanceolate, rather suddenly narrowed into a longer or shorter, sub-filiform acumen, which when dry is flexuose and contracted, so that the leaves are subpiliferous; nerve (as in all the species) weak; margin faintly and distantly denticulate. Cells rather lax, not much differentiated at base.

Perichaetium small, the bracts numerous, erect, shortly subpiliferous, very little toothed, or subentire. Seta short, slender, rarely above 1 cm. high, very densely and rather lowly muriculate; capsule small; lid with a straight or decurved beak. Male flowers often very numerous.

Brotherus places this in Rhynchostegiella, a genus separated from Eurhynchium and Rhynchostegium on account of the small size of the plants, and other minor characters. There is much to be said, I think, for its generic status, but the present plant seems to me hardly at home in it, on account both of the rather large size and the somewhat lax areolation, without the small group of differentiated alar cells which is found in most, if not all, species or Rhynchostegiella. I am inclined to think the restoration of this species to Eurhynchium leaves Rhynchostegiella a more homogeneous and better defined genus.

E. muriculatum appears to be widely distributed, and frequent in shady woods, etc. The var. β, described in the Handbook, does not appear to be of great importance. No specimens exist in Wilson's herbarium, and the only—and rather doubtful—specimen in Hooker's herbarium does not appear to have any very marked characters.

2. **Eurhynchium austrinum** (H. f. & W.) Jaeg. Adumbr. ii, 422 (1876-77).

Syn. *Hypnum austrinum* H. f. & W., Fl. N.Z. ii, 108 (1855); Handb. N.Z. Fl., p. 477.

Robust; nearly always of a dull, dark or dirty green; stems usually prostrate with long, nearly simple, robust branches. Leaves erecto-patent or subsecund, when dry more erect but not much altered or flexuose, rather rigid, about 2 mm. long, widely oval, shortly and not very finely acuminate, closely but not sharply toothed; cells wide and rather short, the primordial utricle often being very conspicuous, and they become laxer at extreme base. Nerve sometimes wide at base, short.

Perichaetia rather large, the bracts erect or somewhat spreading, rather shortly acuminate, toothed. Seta 1.5, rarely 2 cm. high; capsule rather large, turgidly oval.

This species resembles in habit the European *E. rusciforme*, and grows in similar habitats, usually near water; but the leaf structure is quite different.

The var. β, of the Handbook, with smaller leaves and more slender, denser branching, may perhaps be worth taking up.

3. **Eurhynchium asperipes** (Mitt.) Dixon comb. nov.

Syn. *Hypnum asperipes* Mitt. in Journ. Linn. Soc., Bot., iv, 85 (1859). *Hypnum remotifolium* H. f. & W., Fl. N.Z. ii, 108 et Handb. N.Z. Fl. p, 477 (*non H. remotifolium* Grev.).

This plant varies a good deal, and may in the sterile condition be taken for *Rhynchostegium tenuifolium*; the rough seta at once separates it from that, and the leaves are usually very widely cordate-ovate, and suddenly attenuated to a fine, narrow acumen, as well as being differently arranged on the stem; while the narrower, softer leaves of *E. muriculatum* and the habit and colour of *E. austrinum*, will generally distinguish them with ease. In its usual and typical form, *E. asperipes* has a leaf arrangement quite peculiar to itself, and while difficult to describe, recognizable at once when known. In this case the leaves have no tendency to be either complanate or secund; they are imbricated all round the stem, and not very densely; in the moist state they are rather rigidly divaricate, and on drying, the base of the leaf retains a good deal of that direction, while the upper part is bent inwards, so as to be more or less appressed. Consequently the branch or stem becomes to some extent catenulate, with interstices between the leaves, and the appearance is not unlike that of *Eur. striatum* and *E. striatulum* in Europe, though less rigid.

The seta is usually decidedly longer than in *E. muriculatum*, from 1.5 to 2 cm., but occasionally is quite short. The leaf cells are generally rather longer and narrower than those of *E. austrinum*, the width of the lumen being about twice or thrice that of the cell-wall. *E. asperipes* is probably a less common moss than the other two species.

After very careful examination of the plants I have come to the quite definite conclusion that the New Zealand plant is not identical with the South American *H. remotifolium* Grev. Mitten appears to have acquiesced in the reduction of his *H. asperipes* to a synonym, as New Zealand specimens received from his herbarium bear the label "Eurhynchium remotifolium—H. asperipes Mitt."; while another is simply labelled "Hypnum remotifolium."

The identification of the New Zealand plant with the S. American *H. remotifolium* Grev. was made by Wilson, who goes carefully into the question in his herbarium notes. Unfortunately Wilson based his conclusions for the most part on a barren plant of Sinclair's, which does agree very nearly with the S. American plant; but Sinclair's plant is with scarcely a doubt *Rhynchostegium tenuifolium*, which in habit and vegetative structure is scarcely separable from *H. remotifolium*; and the same remark applies to Knight's plant, which in both Hooker's and Wilson's herbaria is without fruit. On the other hand a fruiting plant of Colenso's at Kew—"Col. 670, New Zealand, 1847," which Wilson has named "H. remotifolium Greville? var?"—is certainly Mitten's *H. asperipes*, and is not identical with the American plant; and these comprise the whole of the material on which Wilson's conclusion was based. *H. remotifolium* has widely ovate, *very shortly* pointed leaves, distinctly serrulate all the way round, with a more clearly defined though narrow nerve, and much shorter cells, especially in the upper part of the leaf. It is in fact very close indeed to the European *E. speciosum*, and like that has a synoicous inflorescence, while the New Zealand plants are, I believe always, certainly usually autoicous.

4. **Eurhynchium praelongum** (L.) Hobk. Synopsis of the Brit. Mosses, Ed. 2, p. 206 (1884).

Syn. *Hypnum praelongum* L. Sp. pl., p. 1125. *Eurhynchium Stokesii* (Turn.) Bry. eur., vol. v, t. 526.

This was gathered, sterile, by Mrs. J. Meiklejohn near Diamond Harbour, Canterbury, in April, 1927. It is a rather slender form, but it agrees perfectly with the European plant. As it occurs on the Andes of S. America, its occurrence is not altogether unexpected. It is easily known by its dimorphous leaves, the stem leaves very widely cordate, and longly decurrent at base, rapidly narrowed into a long, fine, squarrose or recurved acumen; the branch leaves much narrower, ovate-lanceolate or lanceolate, gradually tapering, not complanate, sharply denticulate.

The stems are long and straggling, more or less pinnately branched, the branches very slender and soft. The habit is very different from that of the other species, and the colour generally a bright, rather yellowish-green. It is a rather rare fruiter, even in the northern hemisphere, where the plant is common.

RHYNCHOSTEGIUM Bry. eur. v, fasc. 49-51 (1852).

Scarcely distinguishable from Eurhynchium except by the constantly smooth seta, to which may be added a certain laxity of growth and of leaf arrangement, wihch is, however, far from constant. It is probably unsafe to attempt to determine some of the species on vegetative characters alone.

KEY.

1	Leaves narrow, gradually tapering from an ovate base to a rather wide and short acumen; point often broken off; leaves strict, scarcely altered when dry	4. *fragilicuspis*
	Leaves wider, or if narrower abruptly acuminate; not fragile, contracted when dry	2
2	Cells short, primordial utricle usually distinct, leaves abruptly sub-piliferous; seta usually 1 cm., up to 1.25 cm.	1. *laxatum*
	Cells longer, usually empty; leaves more gradually acuminate. Seta usually above 1 cm.	3
3	Perichaetial leaves spreading, capsule oblong-cylindric	2. *tenuifolium*
	Perichaetial leaves erect, capsule narrowly cylindric	3. *cladotheca*

1. **Rhynchostegium laxatum** (Mitt.) Par. Ind., p. 1131 (1897).

Syn. *Hypnum laxatum* Mitt. in Kew Journ. Bot., viii, 264 (1856). *H. aristatum* H. f. & W., Fl. Tasm. ii, 219 (1860); Handb. N.Z. Fl., p. 478. *Rhynchostegium aristatum* Jaeg. Adumbr. ii, 436.

Usually a rather pale green plant, resembling *Eurh. muriculatum,* with which it is frequently mixed, causing much confusion; generally in more compact, less straggling tufts than *R. tenuifolium,* and with smaller leaves, usually but not quite always with more abrupt and longer acuminate points. The leaf margin is usually more sharply serrulate, but this is certainly not constant. The safest character, in my experience, is that of the areolation, which differs from that of *R. tenuifolium* in much the same way as that of *Eurh. austrinum* does from *E. muriculatum* and *E. asperipes,* in having the cells decidedly shorter, and less tapering at the ends, so as to be linear-rhomboid rather than linear-fusiform, while the primordial utricle is usually very distinct; the cells of *R. tenuifolium* being empty and more pellucid. The seta is usually shorter, and the perichaetial leaves shorter and less spreading at the points, often almost erect, but not always so.

After examination of Mitten's type specimens of *Hypnum laxatum* at Kew (Gippsland, Dr. Mueller, 115 and 120a), I am convinced that they are conspecific with the New Zealand plant which has always gone under the name of *R. aristatum*. The descriptions of the two plants, moreover, agree together quite well. No reference is made in the Flora Tasmaniae to *H. laxatum*, with which the authors were probably not acquainted. Curiously, however, in that work the distribution of *H. aristatum* is given as "New Zealand," implying that the authors knew of a record, unspecified, from New Zealand.

R. laxatum is a frequent species.

2. **Rhynchostegium tenuifolium** (Hedw.) Jaeg. Adumbr. ii, 435.

Syn. *Hypnum tenuifolium* Hedw. Sp. Musc., p. 283, t. 75 (1801); Handb. N.Z. Fl., p. 478. *H. confertum* Fl. N.Z. ii, 108 (non *H. confertum* Smith). *H. collatum* H. f. & W., Fl. Tasm. ii, 209. *Rhynchostegium Huttonii* Hampe e Beckett in Trans. N.Z. Inst., xxv, 300 (1892). ? *Hypnum subacutifolium* C. M. e Geheeb in Rev. Bryol. 1877, p. 53.

This common and widely spread moss—its distribution includes a great part of S. America, Australia, and Tasmania—is highly variable, being sometimes very lax and straggling in habit, sometimes more dense, while the leaves vary much in arrangement, in density, size, and degree of serrulation, sometimes being almost entire. It is perhaps always a larger plant than the preceding species, with much larger, more glossy leaves, less shrinking when dry, and the seta is usually, but not constantly longer. The cells are longer, and more pellucid, and the perichaetial leaves longer and more spreading. (N.B.: The figures of the perichaetia of *H. aristatum* and *H. collatum* in Fl. Tasm. ii, t. 176, appear to have been transposed.)

It is very near to the European *R. confertum* and *R. megapolitanum.*

R. Huttonii Hampe MS. in herb. "No. 243, New Zealand; prope *H. murale*" is a rather small form, with setae only 1 cm. long, but differs in no way from specimens of *R. tenuifolium* I possess from Mitten's herbarium, e.g., "New Zealand, coll. Kerr," and "Tasmania, coll. Archer."

H. subacutifolium C.M. e descr. can hardly be anything but this; it is described from a sterile plant, and compared with "*H. acutifolium* H. f. & W."; but the true *H. acutifolium* H. f. & W. is a totally different thing (*Rhaphidostegium acutifolium*).

3. **Rhynchostegium cylindritheca** Dixon in Bull. Torr. Bot. Cl. 42: 108 (1915).

This plant, described and figured in the above publication, appears to be quite a good species, distinct from *R. tenuifolium* in the longer, thinner seta, the long, narrow capsule, and the quite erect perichaetial leaves. The leaf cells are also somewhat narrower (3-5 μ wide as compared with 5-8 μ), and the capsule lid is very finely and longly beaked.

It seems, too, that the time of fruiting is different, the capsules being mature at midsummer, while in *R. tenuifolium* they mature about May to July, but this may be a variable character, as it certainly is in *R. laxatum*.

In addition to the four New Zealand localities cited in the original publication, I have it from the North I., coll. R. Brown ter., and also from "Sydney, Rev. Collie," unnamed in Mitten's herbarium.

4. **Rhynchostegium fragilicuspis** Dixon sp. nov.

E minoribus generis, caespites densiusculos, sat rigidos, *lacte pallide virides* instruens, ramis pinnatis brevibus, substrictis. Folia erecto-patentia, imbricata, *stricta, siccitate minime mutata, nec contracta nec flexuosa*; ovato-lanceolata, *perintegra*, concava, in acumen *strictum breviusculum saepissime fractum* sensim attenuata. Costa ad medium folium versus attingens; cellulae superiores perangustae, parietibus subincrassatis, pellucidis; alares plures, subquadratae, auriculas minimas excavatas instruentes.

Cetera ignota.

Hab. Great Barrier I., 3 May, 1922; W. Gray (7).

The generic position, in the absence of fruit, is somewhat doubtful. The small size, habit, and somewhat well-marked though very small group of alar cells suggest Rhynchostegiella; Dr. Brotherus, however, is inclined to think it a Rhynchostegium, and I have placed it here provisionally. It is quite distinct in the very pale, glossy green patches, with the narrow, entire leaves rigidly suberect and hardly altered when dry, and the points very frequently broken off.

[**Rhynchostegium elusum** (Mitt.) Jaeg. Adumbr. ii. 436.

Syn. *Hypnum elusum* Mitt. in Handb. N.Z. Fl., p. 478 (1867).

I have examined the type of this at Kew (N.E. Valley, Otago, New Zealand, Hector, 1862), and it proves to be a very closely interwoven mixture of *Eurh. muriculatum*, with a few stems of *Rhynch. laxatum*, both in fruit, and so closely resembling one another that I found it practically impossible to separate them except under the microscope, when the smooth seta and the areolation revealed the Rhynchostegium. This explains Mitten's note as "having the appearance of *H. muriculatum*, from which its smooth fruit stalk distinguishes it."

H. elusum is therefore a "composite" species, and must disappear.]

HYPNACEAE.

(For Key to sub-families see p. 304 above.)

Sub-family Plagiotheciae.

Stems usually short and irregularly branched, not pinnate, nor very elongate. Leaves usually more or less complanate, sometimes secund or pointing upward, the lateral obliquely inserted and asymmetrical; two-nerved or nerveless. Seta smooth. Lid usually conical or shortly rostellate. Capsule usually inclined and more or less asymmetrical.

KEY TO GENERA.

1	Cells with fine papillae in rows …… …… ……	*Taxithelium*
	Cells smooth …… …… …… …… …… …… …… ……	2
2	Leaves distichous, equitant, very concave, with abruptly mucronate or shortly pilferous points …… …… …… ……	*Catagonium*
	Leaves not distichous, not very concave …… …… …… ……	3
3	Cells very narrow, scarcely enlarged at base or angles …… …… …… ……	*Isopterygium*
	Cells wider, alar enlarged, lax, often decurrent	*Plagiothecium*

CATAGONIUM C.M. e Brotherus in Engl. & Prantl, Pflanzenfam., Musci, ii, 1087 (1908).* (C.M. in Flora 1885, p. 425 *nomen nudum*).

A small and distinct genus, the leaves in their arrangement very similar to those of Orthorrhynchium, but much less glossy, and the whole plant larger, with quite different fruit.

Catagonium politum (H. f. & W.) Dus. in Rep. of the Princeton Univ. Exped. to Patagonia, viii, 117 (1903).

Syn. *Hypnum politum* H. f. & W. in Lond. Journ. Bot., iii, 353 (1844); Fl. N.Z. ii, 114; Handb. N.Z. Fl., p. 482. *Acrocladium politum* Jaeg. Adumbr. ii, 509.

A highly variable plant in habit and size, sometimes in dense patches, sometimes lax and straggling, the branches sometimes very narrow and occasionally flagelliform, but always showing some of the wide, flattened, distichous fronds; the leaves may be distant and spreading, or closely equitant and almost erect; the apex may terminate almost abruptly, or in a short reflexed mucro, or a flexuose piliform point or arista; the leaves are deeply concave or boat-shaped, usually of a bright glossy green, almost or quite nerveless, entire; the cells extremely narrow. The fruit is rare, the seta 1-2 cm. high, capsule suberect and almost symmetric, or inclined and slightly curved, with a tapering neck; lid beaked, about half as long as the capsule.

It is a frequent, but not abundant species.

It appears to be extremely doubtful whether *C. politum* and *C. mucronatum* (C.M.) are not identical with *C. Auberti* (Schwaegr.) from Bourbon; as far as I am aware the only distinguishing characters given are slight ones drawn from the habit, leaf arrangement, and character of the apiculus. I have not examined the original of *C. Auberti*, without which the question cannot be decided; but both the New Zealand plants and the S. African *C. mucronatum* exhibit such a wide range of forms in the above respects that I am confident that they are unreliable as specific characters, and that the plants probably belong to a single species ranging through the greater part of the extra-tropical southern hemisphere.

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*Catagonium is usually cited as of C. Mueller, but that author, so far as I can discover, never published it as a genus, either with a description or the citation of included species.

TAXITHELIUM (Spruce in sched.) Mitt. Musc. Austr.-Amer., in Journ. Linn. Soc., Bot. xii, 21 (1869).

A genus which is fairly distinct in most of its forms, from Plagiothecium, etc., in the papillose cells, from Trichosteleum in the shortly beaked lid and absence of inflated alar cells; but at times failing, in one species or another, in all these characters. The distribution is mostly tropical, and the New Zealand species is one of the extreme outliers in the southern hemisphere.

Taxithelium polystictum (Mitt.) Jaeg. Adumbr. ii, 489. [Plate X, fig. 12.]

Syn. *Hypnum polystictum* Mitt. in Hook. f., Handb. N.Z. Fl., p. 482 (1867).

I have given some notes on this plant, supplementary to the brief description in the Handbook, in Bull. Torr. Bot. Club, 42: 107 (1915).

It appears to be a very rare plant; and has only been gathered in small quantity in each of the three stations in which it has been found. It does not exist outside New Zealand. The stems while slender are very rigid, stiffly and at times divaricately branched, a very unusual feature in this genus, and more or less complanate; the branches also are somewhat compressed, though the leaves themselves are by no means complanate; altogether it resembles somewhat an extremely slender form of *Acanthocladium extenuatum*.

The leaves vary greatly in outline; they are all very concave, the stem-leaves widely ovate, almost cymbiform, abruptly narrowed to a rather long, flexuose subula, which may be either loriform or finely subulate; the branch leaves vary greatly in the degree of acumination, and may be almost obtuse; they may be quite entire or slightly toothed at apex.

Under the microscope the plant is at once recognized by the seriately papillose cells; each linear-rhomboid cell bearing on its surface a single row of rather coarse, strong, but not very high papillae, about 3-5 on each cell. The alar cells are very marked, three or four at each angle being vesicular and hyaline.

The inflorescence is probably autoicous; the perichaetial leaves are erect and sharply toothed; seta about 1.5 cm., capsule oblique, curved, as in Plagiothecium.

Its only known stations are that of the Handbook (Northern I., unlocalized, coll. Knight); Mt. Egmont, coll. W. Gray, 1912, No. 118a; and Waikopiro, Hawkes Bay, coll. S. Chadwick, herb. G. Webster, No. 995. Both these last are in my herbarium.

PLAGIOTHECIUM Bry. eur., vol. v, Fasc. 48 (1851).

A fairly well defined genus, with complanate leaves, usually distant, asymmetrical, generally rather large and wide, not finely acuminate, with nerve 0 or bifid, and cells rather wide, linear-rhomboid, and markedly enlarged at angles of the leaf. Capsule oblong or cylindric, inclined, curved, frequently striate when dry. Lid short.

KEY.

Autoicous. Leaves acutely pointed	1. *denticulatum*
Dioicous. Leaves widely pointed, almost obtuse	2. *novae-seelandiae*

1. **Plagiothecium denticulatum** (L.) Bry. eur., loc. cit.

> Syn. *Hypnum denticulatum* Linn. sp. pl., ed. 2, 1, p. 1122; Handb. N.Z. Fl., p. 482. *Hypnum lamprostachys* (Hampe) Jaeg. Adumbr., ii, 515.

This very common plant in the north temperate zone appears to be rare in New Zealand. The Handbook cites only one locality; I have it from two other localities, like that in the South I. It is easily known by the glossy, complanate leaves, broad and broadly pointed, entire or slightly toothed at apex, the short, double nerve, rather wide, chlorophyllose cells, very lax at basal angles; the erect, convolute, scarcely acuminate perichaetial leaves, and the rather large capsule, curved and usually somewhat striate when dry.

Hypnum lamprostachys Hampe is certainly only *P. denticulatum.* The distinguishing characters suggested by Hampe, of nerve and leaf form, are perfectly applicable to the ordinary European forms of *P. denticulatum.*

2. **Plagiothecium novae-seelandiae** Broth. in Proc. Linn. Soc. N.S.W. xli, 594 (1916).

As far as I can judge, this differs from *P. denticulatum* solely in the dioicous inflorescence. Brotherus, it is true, describes the leaf as obtuse, and also makes the robust habit a distinguishing character; but in the original plant, from Kelly's Hill, which he kindly sent me, I do not find the leaves obtuse, but shortly and very widely pointed, and though this is different from the ordinary forms of *P. denticulatum*, where the leaves are usually acutely, and sometimes rather longly acuminate, there are also forms (var. *obtusifolium* Hook. & Tayl.) in which they are exactly as here. The robust habit, also, is unreliable, as in a dioicous plant collected by Berggren (No. 2747, Castle Hill, Ins. austr. N.Z.) the plant is similar in habit to ordinary *P. denticulatum,* of which also it has the fruit. The specific status of *P. novae-seelandiae* therefore, is somewhat open to question. It is not, however, the allied dioicous *P. silvaticum.*

ISOPTERYGIUM Mitt., Musc. austr.-amer. in Journ. Linn. Soc., Bot., xii, 21 (1869).

Differs from Plagiothecium in the generally more slender growth, narrower, often finely acuminate leaves, and especially in the very narrow cells, not or scarcely enlarged at the basal angles.

KEY.

1	Leaves grey, very glossy, not complanate, usually strongly falcate or secund; dioicous	1. *limatum*
	Leaves green or whitish, more or less complanate, not very glossy; autoicous	2
2	Leaves minute, less than 1 mm., dull green, entire	2. *pulchellum*
	Leaves larger, 1-1.5 mm., pale whitish-green, entire or faintly denticulate at apex	3. *molliculum*

1. **Isopterygium limatum** (H. f. & W.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1080 (1908).

Syn.* *Hypnum limatum* H. f. & W., Fl. Antarct., Suppl., ii, 345 (1847); Handb. N.Z. Fl., p. 476. *H. terrae-novae* var. *australe* H. f. & W., op. cit., i, 142. *H. australe* C.M. Syn. ii, 302 (1851). *Ectropothecium australe* Jaeg. Adumbr., ii, 524.

A very striking and pretty moss, quite distinct in habit from any other species of Isopterygium, but agreeing in essential characters. It forms exceedingly dense, yellowish or greyish tufts, with very highly glossy leaves, which may be slightly falcate only, but are usually very strongly curved, as in Rhaphidostegium or Stereodon, but with more rigid, shorter, less filiform subula; they also recall slender forms of *Brachythecium paradoxum*, and like that have the leaves somewhat plicate when dry—the absence of nerve of course at once distinguishes them. They are oblong-lanceolate, tapering almost from base, and narrowed above to a short, but very fine acumen, and are quite entire.

The plant is dioicous, the seta about 1.25—1.5 cm. long, the perichaetial leaves erect, strict, ending in a straight filiform point. Capsule almost erect, subcylindric; lid large, highly conical, obtuse.

It appears to be rare, but I have it from some half a dozen different New Zealand localities; it was first described from Campbells Island, and it occurs in Tasmania and Victoria.

[Hypnum (Drepano-hypnum) sublimatum Hampe MS. in Herb. "New Zealand, misit Schimper, No. 302," in Herb. Mus. Brit., is compared by Hampe with *H. limatum* H. f. & W. It has, however, nothing to do with that, but is an Ectropothecium, which might well be *E. Moritzii* (C.M.) or *E. tutuilum* (Sull.). I think there can be no doubt that the supposed New Zealand origin is incorrect.]

2. **Isopterygium pulchellum** (Dicks.) Jaeg. Adumbr., ii, 507.

Syn. *Hypnum pulchellum* Dicks. Pl. crypt. fasc. ii, p. 13 (1790); Handb. N.Z. Fl., p. 476.

A very delicate plant, not unlike a miniature of the preceding species, but softer, greener, with much smaller, narrower, very finely acuminate, almost subulate leaves. The fruit is very similar, but much smaller, though the seta is not much shorter; the capsule is more inclined and the lid more acute.

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*For the synonymy of this species cf. Journ. Bot. 1921, p. 135.

The original plant from New Zealand was referred to var. *nitidulum* (Wahl.), considered by some authors a distinct species; it is slightly larger, with rather wider, more distant, more complanate leaves; but the characters are very slight and indistinct. Other New Zealand plants in my herbarium, collected by R. Brown ter., are much more like typical *I. pulchellum*, and in my experience the variety is too ill defined to be worth keeping up.

I. pulchellum appears to be rare; I have not seen it from the North I.

3. **Isopterygium molliculum** (Sull.) Mitt. in Seem. Fl. Vit., p. 399.

Syn. *Hypnum molliculum* Sull. in Proc. Amer. Acad., iii, 178 (Jan. 1854); Handb. N.Z. Fl., p. 475.

A quite different plant from the two preceding, though the differences are not easy to define. It has no resemblance to *I. limatum*, and could only in its small forms be confused with the var. *nitidulum* of *I. pulchellum*; but it is a considerably larger plant, usually pale whitish-green, with more distant leaves, which are almost always complanate (sometimes slightly decurved), and usually much more divergent from the stem. The perichaetial leaves, while usually erect, are generally less strict, and the subula is often flexuose or spreading. The capsule is very much wider, usually not greatly longer than wide, and is inclined to horizontal, and may even be subpendulous (in which case it is very similar to Ectropothecium). The leaf points may be faintly denticulate, but are mostly entire. There are frequently a few distinctly enlarged and hyaline alar cells, but this too appears to be inconstant.

The Handbook N.Z. Fl. expresses some doubt as to the identity of the New Zealand plant with the Sandwich Is. species; but from a study of a considerable range of the Pacific moss I am inclined to think it a very variable species, which may well include the New Zealand forms. *I. candidum* (C.M.) and *I. argyroleucon* Besch. are I think almost certainly the same thing.

The authors of the Handbook say "operculum in our specimens slender, as long as the capsule." This apears to me an error of observation. In Milne's and Macgillivray's plants in Hooker's herbarium there are very few operculate capsules; I have only detected two; in both of these the lid is shortly beaked only, the lid being about half the length of the capsule. Thus the only suggested difference from Sullivant's original specimen, so far as I am aware, disappears.

It is a rare species in New Zealand, but I have it from an unlocalized spot (doubtless in the North I.), leg. Hutton & Kirk, and also from Rotorua and Taupo, collected by Berggren. These with the original Kermadecs locality are the only New Zealand stations I know of.

Sub-family STEREODONTEAE.

Stems usually more or less pinnate. Leaves usually not inserted obliquely on the stem, more or less distinctly falcate-decurved; alar cells usually distinct, the upper very narrow. Other characters mostly as in Plagiothecieae.

KEY TO GENERA.

1	Capsule small, turgid, almost symmetrical, pendulous	*Ectropothecium*
	Capsule inclined to horizontal, curved	2
2	Leaves sharply denticulate all round, calyptra hairy	*Ctenidium*
	Leaves finely denticulate above only, or entire; calyptra naked	*Stereodon*

ECTROPOTHECIUM Mitt. M. austr.-amer., in Journ. Linn. Soc., xii, 22 (1869).

A large genus of tropical and sub-tropical mosses, in vegetative characters very similar to Stereodon, though usually with the stems more creeping and more regularly, often pectinately pinnate; the small turgid, usually urceolate and symmetrical, pendulous capsule, with very shortly rostellate lid, is the main character. On the other hand, there is often a close resemblance, almost transition, between this genus and Isopterygium, as mentioned under *Isopterygium molliculum*.

Ectropothecium sandwichense (Hook. & Arn.) Mitt. in Seem. Fl. Vit., p. 400.

Syn. *Hypnum sandwichense* Hook. & Arn. in Beechey's Voy., Bot., p. 109 (1841); Handb. N.Z. Fl., p. 477.

A rare species in New Zealand, very similar, vegetatively, to slender forms of *Stereodon chrysogaster*; usually pale or golden yellow in colour. From that species it may be distinguished by the filiform subula of the leaf being generally distinctly denticulate, while in *S. chrysogaster* it is entire; by the narrower leaf base, and the absence of the alar group of rounded cells so characteristic of that species. *E. sandwichense* frequently has a row of about three marginal cells at extreme base which are short and pellucid, the lowest being considerably enlarged, extremely delicate and hyaline; but these do not always occur, and when present may easily be left on the stem unless the leaves are very carefully removed.

When in fruit it is known at once by the autoicous inflorescence, the shorter seta—about 1.5–2 cm., rarely over—and the pendulous, symmetric, oblong or oval-oblong capsule. The colour, the strongly falcate-circinate leaves and denticulate subula will distinguish it from *Isopterygium molliculum*.

It occurs, on trees, in both Islands, but is very rare.

[*Hypnum acinacifolium* Hampe e C.M., Syn. ii, 239, "Nova Seelandia, Strong I., ad radices: Herb. Sonderianum," is referred by Mitten to *H. sandwichense*, but Hampe's specimen shows that it is a true Vesicularia. Strong I., however, is not in the New Zealand region, but in the Caroline Is.]

STEREODON Mitt. M. austr.-amer., in Journ. Linn. Soc., xii, 22 (1869).

[Stereodon is usually cited as of Brid., Bry. univ. ii, 550. In that work, however, Bridel only treats it as a Section of Hypnum, defined as having "Peristomii interioris ciliis imperforatis." In this way he brings together species of Plagiothecium, Rhizogonium, Camptothecium, Calliergon, Thuidium, Rhynchostegium, Eurhynchium, etc., a veritable medley of forms; and it seems absurd to cite him as the authority for a genus of a fairly well defined group of these species, having no relation whatever to the character given by him for his Section Stereodon, even had it been proposed as a genus. As understood here, the genus clearly dates from Mitten's Musci austro-americani, and this apears to me the proper citation of the genus.]

A large genus, of which the cosmopolitan *S. cupressiformis* may be taken as the type; mostly distinguished by the falcate-secund, decurved, filiform-subulate leaves, with more or less distinct alar cells, and the suberect, or horizontal, decurved capsule. In its distribution it is markedly temperate as compared with Ectropothecium. It differs from Rhaphidostegium in the absence of large, vesicular, alar cells, and in the shorter, conical or rostellate lid. All the New Zealand species are dioicous.

KEY.

1	Acumen rather broad and short; alar cells numerous, all small and opaque	3. *maculosus*
	Acumen very finely subulate, lower alar cells enlarged and pellucid	2
2	Alar cells few, orange, not marginal	2. *chrysogaster*
	Alar cells numerous at the extreme angles	1. *cupressiformis*

1. **Stereodon cupressiformis** (L.) Mitt. op. cit., p. 534.

Syn. *Hypnum cupressiforme* Linn. Sp. Pl., p. 1126; Fl. N.Z. ii, 111; Handb. N.Z. Fl., p. 476. *H. Mossmanianum* C.M. in Bot. Zeit. 1851, p. 565. *Stereodon cupressiformis* var. *Mossmani* Mitt. in Journ. Linn. Soc., Bot., iv, 87.

This truly cosmopolitan moss takes so many forms that it is difficult to describe; the student needs to familiarize himself with it in the field, and after some practice it is possible to recognize almost all its forms without recourse to the microscope. The beginner must, however, be prepared to meet with it in almost every variety of colour, size and habit. Perhaps the one most constant and reliable character is found in the alar cells; those at the extreme angles are more or less distinctly enlarged, quadrate, pellucid, occasionally orange, forming a slightly widened auricle; above these where the leaf narrows there is almost always a further group of several much smaller, isodiametric, colourless, usually opaque cells. In some of larger-leaved varieties the pellucid cells are larger, more numerous, and very conspicuous, the upper group much less marked.

In *S. chrysogaster* the extreme angle or auricle of the leaf is not itself composed of enlarged cells, but slightly within the angle (where the leaf actually joins the stem) there is a small group of isodiametric cells, not large or very numerous, but quite distinct, and usually orange or brown (hence the specific name).

In *S. maculosus* there are no enlarged cells, but a rather large group of small, isodiametric, very dark and opaque cells, occupying a great part of the angle.

S. cupressiformis is a very common moss, and some fairly well marked varieties occur, which I have not thought it necessary to detail here. The var. *filiformis* (Brid.), one of the most marked, is a corticolous plant, a very slender, small-leaved form, the branches thread-like, usually rather conspicuously hooked at the tips, and the leaves generally not very strongly falcate.

Hypnum (Cupressina) *cupressinopsis* C.M. in sched.; *H.* (Cupressina) *auridulcea* C.M. in sched.; *H.* (Cupressina) *reflectifolius* C.M. in sched.; all collected by R. Helms, at Greymouth, are all three forms of *S. cupressiformis*. *H. auridulcea* is referred by Paris to *S. chrysogaster*, but my specimen is certainly *S. cupressiformis.*

2. **Stereodon chrysogaster** (C.M.) Mitt. in Journ. Linn. Soc., Bot., iv, 87.

Syn. *Hypnum chrysogaster* C.M., Syn. ii, 295 (1851); Handb. N.Z. Fl., p. 475. *Hypnum patale* H. f. & W., Fl. N.Z. ii, 112.

Resembles *S. cupressiformis* in some of the forms of that species, usually the more slender ones, and is perhaps never safe to determine without microscopical examination. The seta is sometimes, but certainly not always longer.

The alar cells under the microscope, as described under *S. cupressiformis*, are usually if not always quite distinct; still some forms are by no means easy to separate from *S. cupressiformis.*

3. **Stereodon maculosus** Dixon sp. nov.

Stirps habitu formarum nonnullarum *S. cupressiformis;* ramificatione perconferta, ramis dense pinnatis, *crassiusculis, fuscis*, strictiusculis, subobtusis, 3-5 mm. longis; folia dense conferta, valde regulariter falcata vel subcircinata, rigidiuscula, e basi subcordata vel (foliis rameis) ovato-oblonga, *breviter, latiuscule* acuminata, subecostata; marginibus planis, subintegris. Cellulae superiores *breviusculae*, peranguste lineares, parietibus *firmis, subincrassatis*; alares *numerosae, saepe permultae, omnes parvae, subaequales, isodiametricae, peropacae.* Fructus ignotus.

Hab. Great Barrier I., Hutton & Kirk, 81; ex herb. Mitten, comm. Herb. New York Bot. Gard.

This was labelled "*Isothecium pulvinatum* H. f. & W."; i.e., *Camptochaete pulvinata*, to which, indeed, it has some resemblance; the densely pinnate branching, very regular foliation, narrower leaf points, and much more numerous alar cells, sometimes occupying the whole, or nearly the whole width of the leaf base, will readily identify it.

Apart from the alar cells, the dense branching and the short, rather wide, not finely pointed acumen separate it from the two other species.

CTENIDIUM (Schimp. as subgenus) Mitt. M. austr.-amer. in Journ. Linn. Soc., xii, 21 (1869).

A genus difficult to define (Mitten's diagnosis in the place cited above gives no character whatever to distinguish it from e.g. Stereodon); and not very clearly delineated, but generally to be recognized from Stereodon by a certain total of small characters; the leaves are frequently widely spreading or even squarrose, and when falcate-secund are generally much less regularly falcate at the tips, often indeed very flexuose and undulate; the margins are most frequently sharply denticulate, often to the base; the cells generally wider and shorter, and more pellucid, frequently spiculose at the back of leaf from the projection of their apices; they are usually gradually laxer at base and angles, sometimes conspicuously so, but are not vesicular, opaque, or otherwise markedly differentiated. The calyptra is very frequently, usually in fact, pilose; the capsule inclined and curved, usually short and turgid. The fruit, however, is generally very rare, and the fruiting characters are therefore not of much practical help.

Ctenidium pubescens (H. f. & W.) Broth. in Engl. & Prantl. Pflanzenfam., Musci, ii, 1048.

Syn. *Hypnum pubescens* H. f. & W., Fl. N.Z. ii, 113 (1855); Handb. N.Z. Fl., p. 475. *Hypnum pilosum* H. f. & W. in herb. Kew. (? ined.)

This plant is readily known by the dense, soft, dull green tufts, often with an almost metallic sheen, with densely crowded leaves, which may either spread widely on both sides of the stem, or may be strongly falcate and decurved; when dry they are usually longitudinally striate, but may very frequently be strongly transversely undulate, and the points also may be wavy. The sharply toothed margins all round, the somewhat triangular outline of the leaves, with numerous lax cells at the basal angles, are quite distinct. The fruit is extremely rare. The Handbook describes the seta as slightly rough, but this, if it occurs at all, is certainly not constant. The calyptra is pilose.

Mitten in Trans. Linn. Soc., Bot., 2nd Ser., iii, 177, writes of a Japanese moss as agreeing with "the Australian *H. pilosum*, having the foliage neither falcate nor secund, as in the European *Ctenidium molluscum* (Hedw.)." I cannot find that this name was published, but New Zealand specimens are found in Herb. Bescherelle, Herb. Jaeger, and Herb. Kew (in the latter as *Hypnum pilosum* H. f. & W., and *Ctenidium pilosum* H. f. & W., both in Mitten's hand), as well as in Mitten's own herbarium. Whether Mitten thought these plants distinct from *C. pubescens*, or whether *pilosum* is merely a slip for *pubescens*, is not clear; the latter is apparently the explanation, as Mitten in all cases attributed the name to H. f. & W. In any case there is, I think, only one species involved, showing some variation in size, in direction and undulation of leaves.

It appears to be rare in New Zealand, and all the specimens I possess or have seen recorded are from the North I., with the exception of one collected by R. Brown ter., and unlocalized. Brown was in the habit of writing "North I." on his envelopes when a specimen was collected there, and as this was not so endorsed the presumption is that it came from the South I.; but it would hardly be safe to rest the occurrence of the species there on such negative evidence from a single specimen. It occurs also, but I believe rarely, in Eastern Australia.

HYPNODENDRACEAE.

Robust plants, with erect, woody secondary stems from creeping rhizomatous primary stems; the secondary dendroid, the stipes unbranched, naked or tomentose; above with either whorled branches or expanding into a densely branched and often rebranched frond. Leaves large, generally sharply denticulate, with a more or less strong nerve, often excurrent in a toothed arista. Cells mostly smooth, narrow, not markedly differentiated at angles. Capsule on a more or less elongate seta, usually large, inclined or horizontal (in Braithwaitea erect), subcylindric, often furrowed. Peristome perfect, more or less Hypnoid.

The plants belonging to this Family are readily known by their dendroid habit, and large size, the only mosses nearly resembling them being Climacium (which see), of which the fruit (when present) is quite different; and Cryptopodium, which differs widely in the setaceous stem-leaves and immersed fruit. The leaves in the present Family are very little altered when dry.

KEY TO GENERA.

1	Frond elongate, more or less distinctly bipinnate; branch leaves almost obtuse	*Braithwaitea*
	Branches in a close frond or whorled; leaves acute	2
2	Secondary stem or stipes naked; capsule smooth	*Sciadocladus*
	Capsule furrowed	3
3	Stipes without marked tomentum; leaves mostly more or less complanate, plane above	*Hypnodendron*
	Stipes tomentose; leaves crowded, not complanate, usually striate when dry, concave or channelled above	*Mniodendron*

BRAITHWAITEA Lindb. in Act. Soc. Sc. Fenn. x, 250 (1872).

Braithwaitea sulcata (Hook.) Lindb. op. et loc. cit.

Syn. *Leskea sulcata* Hook. Musc. Exot. t. 164 (1819).
Isothecium sulcatum H. f. & W., Fl. N.Z. ii, 104; Handb. N.Z. Fl., p. 464.

Readily known by its Hypnodendroid habit, with naked stipes, and elongate frond which is normally densely bipinnate, but the branches may be robust and simple or only slightly rebranched. In the latter case the plant has much resemblance to Trachyloma, but the densely imbricate, very concave leaves, very widely pointed, with the nerve strong, percurrent, and sharply denticulate at back, will readily separate it from that plant. The fruit, which is rare, is very distinct, being very long and narrow, sulcate, on a seta rather above 1 cm. long, and with long, acute, erect perichaetial bracts.

It is found in both Islands, but is I believe very rare in the South I., and not common anywhere. It occurs also in Australia.

SCIADOCLADUS Lindb. e Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1167 (1909).

The publication of this genus is on the same lines as that of Mniodendron. See note under Hypnodendron.

A small genus of three species, resembling Hypnodendron, but differing essentially in the smooth, not furrowed capsule.

KEY.

Fruits numerous on the same stem; capsule about 3 mm. long, curved	1. *Kerrii*
Fruits single or few; capsule 6 mm. long, straight	2. *Menziesii*

1. **Sciadocladus Kerrii** (Mitt.) Jaeg. e Broth. op. cit., p. 1168.

Syn. *Trachyloma Kerrii* Mitt. in Journ. Linn. Soc., Bot., iv, 86 (1859). *Isothecium Kerrii* Hook. f., Handb. N.Z. Fl., p. 466. *Hypnodendron Helmsii* C.M. in Hedwig. xxxvii, 169, *fide* Brotherus. *Isothecium heterophyllum* Col. in Trans. N.Z. Inst. xx, 240.

The two species of Sciadocladus are almost identical in vegetative characters, very closely resembling *Hypnodendron arcuatum*, which usually has the leaves less crowded, and more or less complanate, with a rather stouter nerve and wider cells (when in fruit the furrowed capsule distinguishes that species at once). For the differences from Climacium see the description of that plant.

I have tried in vain to confirm the vegetative differences between *S. Kerrii* and *S. Menziesii* suggested in the Handbook. I find no difference in the strength of the nerve; it may be generally more coarsely toothed at back in *S. Menziesii*, but this is certainly not constant. The cells in *S. Kerrii* may generally be slightly longer and with the walls a little more incrassate, but this too is unreliable. There is, however, one character which I believe to be of some value; the cells in *S. Kerrii* I have always found quite smooth, while those of *S. Menziesii* project very slightly at the back, at the cell apices, in a minute spiculose point, which may be seen either in profile, or by transmitted light, giving a "punctate" appearance under a high power of the microscope. The leaves in *S. Kerrii* also are nearly always larger than in *S. Menziesii*.

A remarkable aquatic plant collected by Berggren (Rotorua, Tarawera, No. 2576) appears to me to be a form of this species.

parallel to the similarly aquatic form of *Hypnodendron marginatum*. It is scarcely dendroid, much branched, quite without gloss, has narrow leaves much less sharply toothed, the nerve rather roughened than toothed at back, and the cells wider than in the normal plant. It might, however, possibly belong to *Hypnodendron arcuatum*.

Sciadocladus Kerrii is widely distributed in the islands.

The only character given for *Isothecium heterophyllum* Col. that could be of any value is that it is described as having the nerve not percurrent, but vanishing below apex. But in Colenso's own specimen at Kew I find nerves both vanishing and fully percurrent on the same stem, and this is precisely what is found in *S. Kerrii*, as I have verified on a specimen of *S. Kerrii* of Colenso's own naming.

2. **Sciadocladus Menziesii** (Hook.) Lindb. e Broth. op. cit., p. 1168.

Syn. *Hypnum Menziesii* Hook., Musc. Exot., t. 33 (1818). *Isothecium Menziesii* H. f. & W., Fl. N.Z. ii, 105; Handb. N.Z. Fl., p. 465.

See the preceding species for the differences from this fine plant. The lid of the capsule, here, it may be added, is short, conical and obtuse, while in *S. Kerrii* and *Hypnodendron arcuatum* it is shortly beaked.

Its distribution appears to be about the same. Both species are confined to New Zealand, but a third species, closely allied to *S. Menziesii* occurs in New Caledonia.

HYPNODENDRON Mitt. in Seemann, Fl. Vit., 401 (1865), emend. Broth. (Hypnum, Sectio Hypnodendron, C. M. Syn. ii, 496, p.p. Hypnodendron, Lindb. in Oefv. Sv. Vet.-Akad. Foerh. xviii, 374, *nomen nudum*).

It is rather remarkable that while modern authors (Lindberg, Mitten, Brotherus, Fleischer) maintain Hypnodendron and Mniodendron as distinct genera, it seems almost impossible to ascertain their grounds for so doing. Fleischer states clearly that the fruiting characters present no differences, while the vegetative characters suggested by both Brotherus and Fleischer are of the slightest, and certainly do not hold good in all cases. The general foliation as well as the minute leaf structure, e.g., in *Mniodendron Korthalsii* Bry. jav., appears to me quite identical with for instance *Hypnodendron Chalmersii* Mitt. The one character that might seem to be of real value, and fairly well defined, viz., the secondary stems tomentose in Mniodendron, naked in Hypnodendron, is perversely nullified by the exclusion of *Mniodendron Korthalsii* (with naked stipes) from Hypnodendron, on what grounds it is exceedingly difficult to understand.

To understand the facts one naturally goes back to the original publication of the genera. Hypnodendron and Mniodendron are commonly cited as of Lindb. in Oefv. Sv. Vet.-Akad. Foerh. xviii, 375 (1861); but there Lindberg simply gives a list of the species he would refer to these genera with no diagnosis whatever; and by all the rules of nomenclature this does not constitute valid publication; they are all *nomina nuda.* The further citation of the Bryologia javanica is no better. The citation is sometimes given of Hypnodendron (C.M. as Section of Hypnum, Syn. ii, 496) Lindb.; but while C. Mueller characterizes his Section quite clearly it is altogether irrational to cite Lindberg as establishing it as a genus, since that author creates four genera out of the species—or rather some of them—included by C. Mueller in his Section. So far as I can ascertain the first diagnosis of Hypnodendron was by Mitten in the Flora Vitiensis, and of Mniodendron by Brotherus in the Pflanzenfam., Musci, ii, 1170, and there appears no adequate reason for citing Lindberg as the author of Hypnodendron, for which C. Mueller is virtually, though not technically the sponsor. Mitten in the Fl. Vitiensis includes the species of Mniodendron in his Hypnodendron, a view which, as I have said, seems to me a sound one; Mniodendron was separated by Brotherus, in accordance with Lindberg's view, later. As, however, the two genera have been maintained by most of the important works dealing with this Group, I have retained them here for the present.

KEY.

Leaves glossy; cells all elongate, more or less pellucid, marginal similar	1. *arcuatum*
Leaves not glossy; inner cells short, rhomboid-hexagonal, obscure, marginal in several rows elongate, incrassate, forming a distinct border	2. *marginatum*

1. **Hypnodendron arcuatum** (Hedw.) Mitt. in Trans. & Proc. Roy. Soc. Vict., xix, 90 (1883).

Syn. *Hypnum arcuatum* Hedw. Sp. Musc., p. 245, t. lxii. (1801). *Hypnum spininervium* Hook., Musc. Exot., t. 29 (1818). *Hypnodendron spininervium* Jaeg. Adumbr. ii, 623. *Isothecium spininervium* H. f. & W., Fl. N.Z. ii, 105; Handb. N.Z. Fl., p. 466. *Hypnodendron planifrons* C.M. in Hedwig. xxxvii, 170.

This species is known by its secondary stems devoid of tomentum, 3-6 cm. high, the large, glossy, broadly ovate leaves, sharply toothed from near base, the firm, terete nerve with a few strong spinose teeth at back below apex, and often running out into a longly cuspidate, entire point; the cells all narrow linear, those at margin scarcely different, sometimes a little incrassate. The branches are crowded into a dense, short, pinnate or flabellate frond, but are sometimes so closely set as to be almost whorled or umbellate; they are more or less complanate, and nearly always glossy when dry. They vary much in length, and the frond may be from 2 to 4 cm. across. The seta is about 2 cm. long, and usually slightly curved or flexuose, about 2-4 from each stem; capsules slightly curved when ripe, deeply furrowed, about 4-5 mm. long (deoperculate); the lid varies much in length.

H. planifrons C.M. is from the description certainly nothing but a slightly robust form; no other characters are suggested.

It is a common moss.

If the arcuate seta which occasionally occurs were constant in certain plants, it would probably be correct to make it a variety, in which case the specific name of the type would be *spininervium*, as is held by several authors. Comparison of a large number of specimens, however, shows that the curving of the seta is a very slight and inconstant character; both straight and more or less curved setae are often found on the same plant — occasionally a strongly arcuate one—and no defined variety can be founded on this. Consequently Hedwig's name must be retained for the species.

2. **Hypnodendron marginatum** (H. f. & W.) Jaeg. Adumbr. ii, 624.

Syn. *Hypnum marginatum* H. f. & W. in Lond. Journ. Bot. iii, 554 (1844). *Isothecium marginatum* H. f. & W., Fl. N.Z. ii, 106 (1855); Handb. N.Z. Fl., p. 466. *Hypnum limbatum* Sull. in Proc. Amer. Acad. iii, 183 (1854). *Sciaromium limbatum* Jaeg. Adumbr. ii, 556.

A taller, more distinctly dendroid plant (except in the aquatic forms) than the previous species, the stipes reaching to 8 cm. and the frond, which is more distinctly umbellate, with long, spreading and often drooping branches, up to 7 cm. across. The colour of the plant is darker, and without gloss. The leaves are narrowly ovate, much less sharply toothed, the nerve less strongly spinose, and the cells quite different, the inner being short, hexagonal-rhomboid, opaque and obscure with the primordial utricle, the marginal in several rows much longer, linear, incrassate, forming a very distinct, thickened border. The fruit is very similar, but the setae are very numerous on a single stem, and thinner.

The aquatic forms which occasionally occur are very remarkable in habit, being non-dendroid, soft and flaccid, sometimes with the leaves very flattened and bifarious, which has led to their appearing in herbaria as Fissidens, and Octodiceras. Structurally, however, they agree quite well with the typical plant, usually differing only in the less strongly toothed margin and nerve; the characteristic areolation is constant. *Hypnum limbatum* Sull. is one of these forms, differing however from most in having the leaves decidedly narrower, lanceolate and more acute; it was gathered on stones at the bottom of streams.

Sciaromium Bellii differs from these forms in the much less marked border, almost entire leaves, and longer and narrower interior cells.

MNIODENDRON Lindb. e Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1170 (1909). (Hypnum, Section Hypnodendron, Subsect. Comatulina C.M., Syn. ii, 503 pp. Lindb. in Oefv. Sv. Vet.-Akad. Foerh. xviii, 375, *nomen nudum*).

The distinction between Hypnodendron and Mniodendron is by no means a clearly defined one, in spite of the fact that Lindberg considered the former genus to be allied to Thamnium, while he referred Mniodendron to the Bartramiaceae. As understood by Brotherus, indeed, they appear peculiarly ill defined, since the main character, viz., the stems naked in Hypnodendron, tomentose in Mniodendron, is contradicted by *M. Korthalsii* Bry. jav., and *M. parvum* C.M., while the character of the branching (comose in Mniodendron, frondose in Hypnodendron) is equally unreliable. *H. marginatum,* for example, having usually quite definitely comose or umbellate branching. My inclination would be to unite the two, but if maintained distinct, I think the naked or tomentose stipes should be the crucial character, which would at least be an intelligible one, and would leave Mniodendron, at any rate, a small and homogenous genus, and Hypnodendron no more heterogeneous than it is at present.

In any case the New Zealand species of Mniodendron have all tomentose stems, while those of Hypnodendron have them naked.

The New Zealand species of Mniodendron have been much misunderstood; principally, I think, owing to Wilson and also Mitten having formed a wrong conception of *M. Sieberi* (C.M.); and a great number of the specimens in Wilson's and Hooker's herbaria are certainly wrongly named. After a careful study of the descriptions and plants I have come to certain fairly definite conclusions.

I find no plants with the back of the nerve actually toothed, as is claimed for *M. comatum* and *M. Sieberi.* Frequently, or perhaps normally, the excurrent part of the nerve is toothed or spinose, but that is equally true of *M. comosum.*

The length of the setae and their number on a stem is of no value whatever, striking as is the difference at times. Thus certain plants of *M. comatum* have the setae always single, and from 4 to 5 cm. long, while the usual case is to have them crowded, up to 6 and more together, and only about 2 cm. long; but I can find absolutely no characters correlated with these different conditions, and all intermediate stages occur; the same gathering, for instance, will show a single seta on one stem and 8 or 9 on an adjoining one; while in another case, out of four plants from a single gathering, all with the long form of seta, three stems have a single seta each, while the fourth has three.

Nearly all the plants I have seen fall into two distinct groups; *M. comosum,* a very robust plant with stout, straight, more or less erect branches, a very stout nerve, and margin of leaf more or less bi-stratose; and *M. comatum,* often taller but always less robust, with the branches in a more distinct comal tuft, much more slender, often tapering, and generally more or less decurved or sub-pendulous; the nerve much weaker, the margin of the leaf unistratose. In both species the degree of dentation of the leaf margin and the excurrent arista varies very greatly.

The question remains what is *M. Sieberi*? According to C. Mueller this is very close indeed to *M. comatum,* but differs in the margin being "subincrassate," and Brotherus places it, with *M. comosum,* in the Section having margin of leaves bi-stratose, and nerve at back distantly spinose. I have seen no plant with nerve spinose at back of leaf, and the only plant I have seen that departs at all widely from the two types described above is a plant in herb. Hooker "N. Hold., ex herb. Drummond," which has a nerve intermediate in thickness between *M. comosum* and *M. comatum*, and a bi-stratose margin. This may be C. Mueller's *H. Sieberi*, but in any case I incline to think it only a marked form or variety of *M. comosum*. In any event I have seen no New Zealand plants that agree at all with the description of *M. Sieberi*, and I have omitted it from the list.

I have seen no Australian plants of *M. comatum*, which appears to be by far the most common New Zealand species, and occurs in Tasmania; *M. comosum*, however, is found in New Zealand, Tasmania, and Australia, as well as in the Auckland Is. and Campbell I.

1. **Mniodendron comosum** (La Bill.) Lindb. e Broth. in Engl. & Prantl, Pflanzenfam., Musci, ii, 1172.

Syn. *Hypnum comosum* La Bill., Pl. Nov. Holl. ii, 107 (1804-06). *Isothecium comosum* Brid., Bry. univ. ii, 374; Fl. N.Z. ii, 106; Handb. N.Z. Fl., p. 466. *Hypnum Kroneanum* C.M. e Geheeb in Rev. Bryol. 1877, p. 53.

Known by its robust habit, often reddish colour, stout, straight, not tapering, recurved nor pendulous branches, but more or less erect, the very stout nerve, and the leaf border more or less incrassate. The setae may be two or three together, but are not, I believe, ever numerous, and are probably constantly longer than in the short-setaed form of *M. comatum*.

The Auckland Is. plant (*Hypnum Kroneanum* C.M.), cannot be separated; the alar cells are in no way distinct from those of New Zealand and Australian plants.

The species appears to be rare, but is widely distributed.

2. **Mniodendron comatum** (C.M.) Lindb. e Broth. op. et loc. cit.

Syn. *Hypnum comatum* C.M. Syn. i, 692 (1851). *Isothecium comatum* Hook. f., Handb. N.Z. Fl., p. 467. *Isothecium Colensoi* H. f. & W., Fl. Tasm. ii, 207. *Isothecium tomentosum* Col. in Trans. N.Z. Inst. xx, 242 (1887). *Mniodendron brevisetum* Reichh., Novara Exped., Botany, p. 189 (1870).

A very beautiful, while common and very variable plant, as mentioned in the notes under the genus; the leaf structure, however, is fairly constant, though the degree of marginal serration varies much. The variability, or rather perhaps dimorphism in the number and length of the setae is a very unusual feature. In the common form the setae are very numerous and short, so that the capsules are crowded together. The branches are constantly less robust than in *M. comosum*, frequently flexuose, curved, and tapering; the nerve is much narrower, and the leaf margin constantly unistratose.

It is frequent in New Zealand, and extends to Tasmania, but not beyond.

Isothecium tomentosum Col., from the description certainly belongs here.

Reichhardt has given a very detailed and useful description, with figures, of his *M. brevisetum*; but his species is based almost entirely on the numerous short setae, which are really characteristic of the normal forms of *M. comatum*; Reichhardt had probably only seen the form with single (or few) elongated setae, which would naturally account for his seeing a new species in the other form.

NEMATACEAE.

Ephemeropsis tjibodensis Goeb. in Flora, 1892, p. 98, emend. Fleisch. in Hedwig. xxxviii, 8 (1899).

While the present part was in the press I received through Mr. Sainsbury a fruiting specimen of this plant, the only representative of the Family, collected by Mr. K. W. Allison in April, 1928, on bark of Manuka, from Atiamuri, Waikato R. The N.Z. plant shows some slight differences from the Malayan form; the proronema is dull green, not brown (but I find this also in a specimen from Penang); the branches are often longer, narrower, and less divaricate, often indeed parallel; nor have I, so far, seen any of the "Assimilationsorgane" which form so conspicuous a part of the Malayan plant. The ♂ flowers, however, and the capsules, are practically identical with the Javan form, though the setat shows some slight trace of roughness.

Brotherus gives the distribution of *E. tjibodensis* as Java, Sumatra, W. coast of the Malay Penins., and New Guinea. I have it also from three localities in Siam.

So far as I am aware the fruit has only once been gathered hitherto in Java. In the sterile state the plant may easily be passed over as a minute alga, or the protonema of an ordinary moss. Its position, on account of the fruiting characters, is considered to be near the Hookeriaceae. In the entire absence of stems and leaves it is one of the most remarkable forms of moss.

A full description, with figures, will be found in Fleischer, Musci . . . . von Buitenzorg, vol. iii.

ANDREAEACEAE.

ANDREAEA Ehrh. in Hannov. Mag., 1778, p. 1601.

Over 30 species of this genus have been recorded from New Zealand, besides half-a-dozen herbarium names which have not been published; of these, however, a very considerable reduction needs to be made, and the actual number of valid species certainly does not exceed ten.

The principal difficulty in the classification of the species lies in the nerveless group of the subgenus Eu-andreaea. I cannot profess to have obtained a clear conception of these, and they require further study in the field. Moreover, the higher altitudes in which these plants usually occur have not been widely investigated, and a closer study will probably lead to fresh important conclusions on the genus in more than one direction; three possible directions at least may be suggested: it is likely that many more forms may be discovered, which may increase the number of New Zealand species considerably; while on the other hand they may quite conceivably reduce the present number by showing that some of the plants here treated as independent species are really forms only of some of the others. And it is highly probable that a fuller knowledge of the New Zealand forms will result in the identification of more than one species with plants of the subantarctic region, especially of Fuegia, where a considerable number of new species have been described by Dusèn and others, without apparently a close comparison being made with the New Zealand forms.

The *petrophila* group, as it may be called, presents great perplexities. As in other genera, characters which have little value have been relied on in the past to separate species. Especially this is the case with the papillosity of the leaves, which may exhibit a great range of development on a single stem, much more on a single tuft. To a less extent this applies to the character drawn from the toothing or otherwise of the basal margin of the leaves; this is no doubt in some species a useful and constant character; but in *A. acuminata* at least the margin may be either toothed or entire.

Andreaea has been divided into two, and later into three subgenera. Hook. f. & Wils. separated Acroschisma from the rest of the genus partly on the ground of the valves of the capsule occasionally numbering more than four, up to eight (each valve occasionally having a secondary fissure), and also on the character that the valves do not extend to the base of the capsule, the greater part of which remains undivided.

More recently Lindberg has employed another character to divide the remaining species, viz., Eu-andreaea, where the perichaetial leaves are large, convolute, much differentiated from the stem leaves; and Chasmocalyx, in which they are very little differentiated, not large and convolute. These three subdivisions form the basis of Brotherus's classification in the "Musci," and of Roth's in the Aussereuropaisch. Laubmoose, vol. 1.

I have already (Smithsonian Miscell. Colls. [1918] 69: 2, p. 9), called attention to a structural peculiarity in an Andreaea from Mt. Kenia, which suggests the possibility that the principal character on which Acroschisma is founded is of less stability than its authors supposed. This conclusion is supported, indeed confirmed, by examination of another group of species. C. Mueller (Syn. i, 8) writes of *A. subenervis* H. f. & W. from the Andes of New Granada, that from the form of the capsule it appears to be nearest to *A. Wilsoni* (i.e., Acroschisma). Examination of Wilson's specimens of *A. subenervis* at the British Museum entirely confirms this; the capsules are, and are sketched by Wilson entirely of this character, the basal portion—perhaps two-thirds of the capsule—being entirely undivided, though this is not the case in the single capsule of the Quito specimen. Now in the New Zealand *A. aquatica* and *A. nitida*, both of which are to say the least closely allied to *A. subenervis,* the capsule is perfectly normal for Andreaea, i.e., the valves reach to the base. It appears best, therefore, to retain the New Zealand species under Chasmocalyx, leaving Acroschisma provisionally a monotypic subgenus based upon the number of valves as well as upon the degree of fission of the capsule.

The following is a tentative Key to the species, but I must frankly admit that it is probable that some of the separating characters given may prove valueless, while it is possible that other and better ones exist which I have overlooked.

KEY.

1	Leaves widely elliptical to suborbicular, obtuse and apiculate, large; nerve 0 or short, wide and faint	2
	Leaves more or less oblong or lanceolate, much longer than wide	3
2	Glossy, leaves widely elliptic, firm, margin narrowly reflexed, especially when dry, nerve generally wanting	6. *nitida*
	Scarcely glossy, leaves very large, suborbicular, margin scarcely reflexed, nerve generally present	7. *aquatica*
3	Leaves nerved	4
	Leaves nerveless	6
4	Leaves linear-subulate from a wider base, mostly falcate; nerve at base paler than lamina	5. *subulata*
	Leaves oblong or lingulate-oblong, broad above, nerve darker than lamina	5
5	Rupestral, leaves 1-1.5 mm. long, lingulate-oblong	8. *australis*
	Aquatic, robust, leaves 2-3 mm. long, .7-.9 mm. wide near base	9. *aquatilis*
6	Autoicous, leaves when dry appressed with the points spreading, slightly lyrate at base, longly acuminate, more or less papillose, often crenulate at margin above base	2. *acuminata*
	Dioicous, very variable, margin mostly entire	7
7	Leaves erect when dry, elongate, linear-subulate from a wider base, quite smooth, all basal cells narrow	3. *acutifolia*
	Leaves more or less falcate and secund, from a short oval base abruptly narrowed to a long, narrow, linear, acute subula; cells smooth	4. *micro-vaginata*
	Leaves usually more or less spreading at the points when dry, especially at base of stem, cells usually papillose, upper part of leaf not extremely narrowed nor subulate, oblong or lanceolate, often broad and rounded at apex; highly variable	1. *petrophila*

Sub-genus EU-ANDREAEA Lindb. Perichaetial leaves large, convolute, very distinct from the stem leaves.

A. LEAVES NERVELESS.

1. **Andreaea petrophila** Ehrh. in Hann. Mag. 1784, p. 140. Handb. N.Z. Fl., p. 400.

Syn. *A. mutabilis* H. f. & W. in Lond. Journ. Bot., iii (1844), p. 536; Handb. N.Z. Fl., p. 400. *A. novae-zelandiae* R. Br. ter. in Trans. N. Z. Inst., vol. 25, p. 278 (1892). *A. gibbosa* R. Br. ter., op. cit., p. 278. *A. minuta* R. Br. ter., op. cit., p. 278. *A. dioica* R. Br. ter. op. et loc. cit. *A. Wrightii* R. Br. ter., op. cit., p. 279. *A. Huttonii* R. Br. ter., op. et loc. cit. *A. amblyophylla*

C.M. e Broth. in Oefv. af Finska Vet.-Soc. Foerh. Bd. 34, p. 47 (1895). *A. flexuosa* R. Br. ter., op. cit. p. 279. *A. pulvinata* C.M. & Beckett in Trans. N.Z. Inst., vol. 25, p. 293. *A. Arthuriana* C.M. in Hedwig., vol. 37, p. 79. *A. filamentosa* C.M. op. cit. p. 80. *A. novae-zelandiae* Schimp. MS. in Herb. e Roth, Aussereuropaïsch. Laubmoose, 1, p. 45 (excl. syn.) 1910.

A highly variable plant in size, leaf outline and direction, etc. Usually however to be recognized by the comparatively short leaves, often widely spreading, especially at the base of the stem, the margin above base entire, rarely minutely crenulate, the upper part of the leaf narrowed, but generally not very greatly so nor very abruptly; acute, acuminate or obtuse—at times quite broadly rounded and subcucullate; the cells generally markedly papillose, but occasionally smooth or nearly so. Many varieties have been created, but the limits are very difficult to define.

A. gibbosa R. Br. ter. is not represented in his herbarium, but from the description and figures I can feel no doubt that it belongs here; the other species reduced in the above synonymy I have examined. *A. Huttonii* is one of the most marked forms, with rather large, long, often very obtuse leaves. The cells are not smooth, as described by Roth, but papillose, though variably and often indistinctly. I have examined an original specimen of *A. amblyophylla* C.M. from Knocklofty, Tasmania, coll. W. A. Weymouth, No. 1618 (Herb. R. Br. ter.) and I cannot separate it from *A. petrophila*. Brotherus in describing the species remarks that it appears very near *A. Huttonii* R. Br. ter., and this was Brown's own view, as he has marked the specimen of *A. amblyophylla* (coll. Weymouth) "Huttonii," implying that he considered it identical. R. Brown's specimens of his *A. Huttonii* entirely bear this out. Brotherus says of *A. amblyophylla* that it is like *A. petrophila*, but separable at once by the leaves rotundate-obtuse. A comparison of the figures of the leaves of *A. Huttonii* or *A. amblyophylla*, however, with the figures of those of *A. petrophila* in the Bry. Eur., tab. 623, shows them as nearly identical as possible; in fact the plant of the Bry. Eur. which the authors take as the typical form, shows the leaf even more widely rounded and obtuse than is usually the case in *A. amblyophylla*. C. Mueller has redescribed his species (*A. amblyophylla*) in Hedwig., vol. 37, p. 82. *A. flexuosa* R. Br. ter. is an intermediate form, connecting it with more typical forms of *A. petrophila*.

After much hesitation I have decided that *A. mutabilis* H. f. & W. must be considered as synonymous with *A. petrophila*. The authors do not either in the original description or in the Handbook suggest any important differences, nor are later authors able to supply any. The only character of importance is that the basal margin is described as *sometimes crenulate*. This is actually the case in some of Hooker's original gatherings, but in others it is quite absent, while at the most it is scarcely more than a slight protuberance of the marginal cells. This is not unknown in European *A. petrophila*, though it is certainly unusual. (Limpricht in describing that species says of the leaves "zuweilen am Rande durch vorspringende Zellen kerbig"—which however may not be intended to apply to the basal part.) In any case quite a number of specimens show some of the leaves entire while others are crenulate. In a fine specimen from Mt. Thompson, Stewart I., in Brown's herbarium, which would no doubt come under *A. mutabilis*, I find not only some leaves entire and some markedly crenulate-denticulate, but here and there leaves with one margin crenulate and the other quite entire; so that the character cannot at the best be anything but a minor one, in this species; and with equal certainty it may be said that in those cases where the margin is entire there is absolutely nothing to separate the plants from *A. petrophila*.

A. novae-zealandiae Schimp. MS. in herb. is a tall "mutabilis" form. It was collected by Dr. Julius Haast. There is absolutely no connection between this and R. Brown's species of the same name, and Roth in his description and figures has mixed up the two quite gratuitously. Both however happen to be forms of *A. petrophila*, though quite diverse ones.

A. minuta R. Br. ter. only differs from *A. petrophila* in the minute size of all its parts; the leaves extremely narrow, almost subulate above, and the cell walls rather thin for the genus. The stems in Brown's type are only 3-4 mm. high, the leaves about .25mm. long.

A. petrophila is a very common species in all the districts favourable to Andreaea.

2. **A. acuminata** Mitt. in Journ. Linn. Soc., Bot., iv, 64 (1859).
Syn. ? *A. homomalla* C.M. in Hedwig., vol. 37, p. 80.

This species closely resembles the acute leaved forms of *A. petrophila*, but is autoicous; the leaves are somewhat spreading; longly and narrowly, acutely acuminate from an erect, ovate or slightly lyrate base, and when dry are closely appressed in their lower part with the apices rather rigidly divergent; the margin near the base is usually—but certainly not constantly—crenulate-denticulate, and the upper cells are rather markedly wide, having the lumen usually at least equal in width to the cell-walls; the basal are elongate and incrassate throughout the width of the base; the upper papillose, but not strongly so; the perichaetial leaves are sharply acuminate.

Considering, however, the variability of *A. petrophila*, it is not easy to separate from forms of that species; the autoicous inflorescence is perhaps the most important character, and the elongate cells throughout the base a practical one; but this is also characteristic of *A. acutifolia*, and occurs sometimes, though I believe rarely, in *A. petrophila*.

It is probably not very common.

In all probability *A. homomalla* C.M. is synonymous, since according to Roth it is autoicous; the description however gives no distinctive marks by which it could be separated from several of the allied species.

3. **A. acutifolia** H. f. & W. in Lond. Journ. of Bot., iii, (1844), p. 535; Handb. N.Z. Fl., p. 400.

This appears a fairly distinct species, for the group. The leaves are rather large, long and narrow, straight and erect when dry, not having the upper part reflexed; the base ovate-lanceolate or very indistinctly lyrate, with entire margin, the subula long, narrow, and very opaque; the basal cells are all elongate, and highly incrassate, the upper very incrassate and smooth.

A. acutifolia has a wide distribution in the subantarctic insular regions, including the Auckland and Campbell Is.; in the Kew and British Museum collections there are only two specimens (both belonging to Herb. Hooker) from New Zealand itself, under this name, and both belong, I believe, to other species: Colenso, 2743, appears to be *A. petrophila*, and Colenso, 2934, probably *A. acuminata*. A specimen however from Mt. Earnshaw, L. Wakatipu, 4-5,000 ft., Jan. 1890, collected by W. Bell, and sent me by Mr. Petrie, apears to be quite correctly referred here. And a specimen in Brown's herbarium, *A. subulata* R. Br. ter. MS. in Herb., Craigieburn, West Coast Road, coll. R. Brown, is the same thing. It is evidently a rare species in New Zealand.

4. **A. micro-vaginata** C.M. in Hedwig., xxxvii, 80 (1898).

I have seen no specimen of this, and am not clear of its affinity. The original description is vague; Roth's figures however show a leaf very different from any of the other species of this group, having the leaves longly and narrowly subulate from a very small short ovate base.

Both C. Mueller and Roth describe the leaves as nerveless, and Roth figures them so. Frankly, however, I strongly suspect the leaves to be nerved, and the plant to be nothing more than *A. subulata*, in which the nerve is broad and very ill-defined, so as to appear as nerveless, and indeed the species was at first described as such; the rest of the description of the present plant by Roth and by its author strongly points in that direction. In the absence, however, of authentic specimens, and the distinct statement on the part of both authors that the leaves are nerveless, I feel bound to retain the species.

It was collected by Beckett on rocks by lake, Kelly's Range, Westland.

B. LEAVES NERVED.

5. **A. subulata** Harv. in Hook. Ic. Pl. Rar. III, t. 201 (1841); Handb. N.Z. Fl., p. 400.

Syn. *A. pseudo-subulata* C.M. in Bot. Zeit. xxx, 1864, p. 373. *A. dicranoides* R. Br. ter. in Trans. N.Z. Inst., vol. 25, p. 280. *A. Cockaynei* R. Br. ter., op. cit., p. 281. *A. Jonesii* R. Br. ter., op. et loc. cit. *A. arctoaeoides* C.M. & Beck., op. cit., vol. 25, p. 293. *A. subulatissima* C.M. in Hedwig., vol. 37, p. 83.

This very distinct species was first described from the Cape of Good Hope, and C. Mueller created his *A. pseudo-subulata* to distinguish the Fuegian species, while Hook. f. & Wils. have further distinguished two varieties, var. *rigida* and var. *perichaetialis*. After examining the types of these and a considerable range of New

Zealand specimens I am fully persuaded both that the Australasian and American plants are in no way separable from the African species, and that the varieties rest on too slight characters to be worth maintaining. I have also examined original specimens of the other three species of R. Brown's given in the synonymy, and of *A. arctoacoides* C.M. & Beck. (re-described by C. Mueller in Hedwig. xxxvii. 83) and they are all simply referable to the same species, as is without doubt, from the descriptions and from Roth's figures, *A. subulatissima* C.M.

A. subulata is a very distinct species, in habit more resembling a Blindia or a Dicranum or Dicranella, from the usually very falcate, often blackish leaves. The leaves may be erect or nearly so, or strongly falcate, almost circinate; most commonly the subula is more or less falcate from an erect base. The structure of the leaves is peculiar, and as mentioned above, has led to the plant being included in the nerveless species. The nerve is rather broad, and very ill-defined, in the opaque, thickened acumen filling most of the subula, and passing insensibly into the lamina cells, which are, however, continued for at any rate some distance upwards, if not to the apex. In the basal part, instead of being darker, the nerve is much paler than the lamina cells, orange and subpellucid, while the lamina cells are short, obscure and dark; the nerve has much the same appearance here, therefore, as is given in some of the nerveless species—e.g., *A. petrophila*—by the elongate basal cells as compared with the shorter marginal ones.

The perichaetial leaves are nerved, and end in an opaque rigid subula variable in length. The capsule is very shortly exserted or may be quite immersed.

It appears to be a species of the higher altitudes, and probably fairly widely distributed.

Subgenus CHASMOCALYX Lindb.

Perichaetial leaves small, not greatly differentiated from the stem leaves.

6. **A. nitida** H. f. & W. in Lond. Journ. of Bot. iii, p. 535 (1844); Handb. N.Z. Fl., p. 400

Syn. *A. ovalifolia* R. Br. ter. in Trans. N.Z. Inst., xxv (1892), p. 280.

This species and *A. aquatica* form a type entirely different from all the other species of the genus, and should possibly form a separate subgenus; at any rate the character of the perichaetial leaves on which Chasmocalyx is founded does not apply very distinctly here; the perichaetial leaves are rather conspicuous, at least twice as large as the stem leaves, and to a considerable extent convolute.

The leaves are large, ovate-elliptic, not at all narrowed above, except that the widely rounded apex is shortly apiculate; the nerve is present, but is broad and ill-defined at margin, variable in length, but rarely reaching above half-way, and often very indistinct altogether.

It is recorded from Tasmania, N.Z. (South I.), and Auckland Is. *A. ovalifolia* R. Br. ter. is quite the same thing; often blackish and sometimes running into a rather large form.

7. **A. aquatica** R. Br. ter. in Trans. N.Z. Inst. xxv (1892), p. 280.

Syn. *A. apiculata* R. Br. ter., op. et loc. cit. *A. cochlearifolia* C.M. & Beckett, op. cit., p. 293, et Hedwig. xxxvii, 81. *A. aquatica* C.M. op. cit. p. 82. *A. obtusissima* C.M., op. cit. p. 83.

This is a fine plant, and, as Brown remarks, the most beautiful of all the New Zealand Andreaeas, growing in water, with stems two to four inches long, and with large leaves reaching 2 mm. in length, widely elliptic to nearly orbicular. The structure is however identical with *A. nitida*; and it is doubtful whether it be more than a robust, aquatic form of this; the character derived from the leaf-margin, recurved in *nitida*, but erect in *aquatica*, is not reliable, as in each species both forms of margin may be seen side by side on the same plant. Roth indeed (Aussereuropaisch. Laubm. i, 79) attempts to find a distinction in the areolation, placing *A. nitida* and *A. ovalifolia* in a section with the cells only slightly incrassate, and *A. aquatica*, *A. cochlearifolia*, and *A. obtusissima* in another with the cells more strongly incrassate, and more or less sinuate. I do not, however, find this in any way borne out by the actual plants; and moreover Roth's own figures (to which he refers) do nothing to support it, as he draws the upper cells of *A. nitida* much more incrassate than those of *A. cochlearifolia*!

A. aquatica C.M. (Hedwig. xxxvii) is a re-description of Brown's species from his own type specimen—or co-type! I have seen an original gathering of *A. cochlearifolia* C.M. & Beckett (again re-described by C.M. in Hedwigia), and it is certainly the same thing. I have seen no specimen of *A. obtusissima* C.M., but the descriptions and Roth's figures leave no doubt of its being simply *A. aquatica*.

The same is the case with *A. apiculata* R. Br. ter., of which the type specimen exists in Brown's herbarium. It is a smaller plant than most forms, and in some ways exhibits an intermediate character between *A. nitida* and *A. aquatica*, but it has at times at least the large, flaccid, less glossy leaves of *A. aquatica*.

After careful comparison of the New Zealand plant with the original specimens in Hooker's and Wilson's herbaria of *A. subenervis* H. f. & W. from high altitudes on the mountains of New Granada and Quito, I have very little doubt that they all belong to the same species, and I should have reunited them as *A. subenervis* but that a further question remains, which on the available material I do not feel able to resolve, whether *A. subenervis*, *A. nitida*, and *A. aquatica* are more than forms of the same species, *A. aquatica* representing a robust, aquatic form. The original *A. subenervis* is based on two plants, Purdie's from near the snow line of the New Granada Andes, and Jameson's from a similar elevation on Pinchincha, Quito. The latter is exactly—in vegetative characters—the N.Z. *A. aquatica*, and the single capsule is normal, as in the N.Z.

plant. Purdie's plant, the type, is more like *A. nitida* in habit and leaf form, but with the margin mostly erect; while the capsule is distinctly in form that of Acroschisma. Either then the two are, as Wilson determined them, two forms of a single species, in which case all the N.Z. plants of *A. nitida* and *A. aquatica* must be united with it; or if, on the other hand, the two S. American plants are considered distinct, the Pinchincha plant and the N.Z. *A. aquatica* must certainly be put together, while the New Granada *A. subenervis* will be kept independent and will retain its name, and the *A. nitida* of N.Z. either be united with it or retain its position and name. I think the question will only be fully solved when further material is available of the S. American plants.

As far as the geographical distribution is concerned there is nothing unexpected in a species being common to the high altitudes of the Andes and the New Zealand mountains, but it is very unusual in such a case for the species not to appear in the subantarctic Islands or Fuegia, more especially in a genus so well represented in those regions.

8. **A. australis** F. Muell. MS. in sched., e Mitt. in Hooker's Journ. of Bot. 1856, p. 257.

Syn. *A. clintoniensis* R. Br. ter. in Trans. N.Z. Inst. xxv, 281. *A. lanceolata* R. Br. ter., op. cit., p. 282 (nec. *A. lanceolata* Dus. MS. in sched. e Roth, Aussereurop. Laubm. i, 62 (1910).

Var. Mitchellii (Broth. & Dix.) Dixon comb. nov.

Syn. *A. Mitchellii* Broth. & Dix. in Journ. Linn. Soc., Bot., vol. xl., p. 434 (1912).

I have examined original specimens of F. Mueller's *A. australis* ("Mt. Wellington, Austral. Felix, Dr. F. Mueller," in Herb. Hampe) and find it exactly the same as the New Zealand plant. It is very variable in habit and size and density of leaves, but structurally there is little difference in all the forms; though the leaves differ somewhat in their degree of obtuseness, being sometimes equal in width to near apex, then suddenly rounded and subobtuse, or bluntly apiculate, while at other times they taper more gradually to a subobtuse point. The oblong-lingulate leaves with incurved tips and more or less reflexed margins, concave, and carinate with the stout brown nerve, which reaches close to the apex, are quite different from those of any other species.

A. lanceolata R. Br. ter. is a somewhat robust form.

A. Mitchellii Broth. & Dix. cannot, I find, on comparison with other N.Z. forms, be specifically separated, but it may be retained as a variety, having larger, much laxer leaves, and cells decidedly larger, more distinct, more regularly hexagonal, 6-8 μ wide, as against 5-6 μ in the ordinary forms. Whether these characters are constant, however, is somewhat doubtful, and can only be determined by field study.

A. australis appears to be a rare species.

9. **A. aquatilis** R. Br. ter. in Trans. N.Z. Inst., xxv. p. 282 (1892). Syn. *A. subfluitans* C.M. in Hedwig. xxxvii, 81 (1898).

A tall, fine plant, bearing the same relationship to *A. australis* that *A. aquatica* does to *A. nitida*, and, as in that case, of doubtful specific rank. Structurally I find no difference; but the leaves are larger, often very broad below and flexuose-undulate, and more laxly disposed.

Original specimens of *A. subfluitans* at Kew, from Kelly's Hill, Westland, are exactly *A. aquatilis*; in fact it is clear—locality, date and collector being the same—that it is simply Brown's own type of *A. aquatilis* being described over again under a new name!

SPHAGNACEAE.

SPHAGNUM Ehrh.

The following treatment of Sphagnum is almost entirely taken from Warnstorf, Sphagnaceae (in Engler, Das Pflanzenreich, Heft 51, 1911). Comparing the species given in the Handbook with that work, *S. cuspidatum* is divided into eight species; *S. subsecundum* disappears from the New Zealand list; *S. cymbifolium* is divided into seven species; *S. australe* becomes a var. of *S. antarcticum*; and *S. acutifolium* also disappears.

Of several of Warnstorf's species I have only seen the descriptions, and am able to give no opinion of their value. A careful investigation of the New Zealand members of the genus in the light of the newer treatment, but with an independent judgment brought to bear on it, would be a very valuable study.

It should be mentioned that for an exact study of the structure of the stem and leaves of Sphagnum, staining—with e.g., methyl violet—is always desirable, and at times quite necessary. It is also necessary to make transverse sections of the branch-leaves.

It will aid the student if I give a Key to the Sections and Subsections as treated by Warnstorf.

Sect. I. LITOPHLOEA Russ.

Internal walls of the epidermal cells of stems and branches *without spiral fibres*; apex of branch leaves nearly always truncate and toothed. Inner walls of the hyaline cells of branch leaves smooth.

Subsect. ACUTIFOLIA.

Branch-leaves of medium size or small, lanceolate to ovate-lanceolate, when dry sometimes recurved, but otherwise little altered, not undulate, with a very narrow, entire border. Hyaline cells of branch leaves with large pores. Chlorophyll cells in transverse section either triangular or trapezioid, situated on inner face of leaf, enclosed at back or free on both surfaces. Colour variable, green in the only New Zealand species.

Subsect. RIGIDA.

Branch-leaves rather large, ovate at base, usually narrowed above the middle and truncate at apex, scarcely bordered. Pores variable. Chlorophyllose cells in section elliptic, fusiform or barrel-shaped, median or nearer the dorsal face of the leaf. Colour often brownish or flesh coloured.

Subsect. CUSPIDATA.

Branch-leaves variable in form, ovate-lanceolate to linear-lanceolate, when dry usually less concave, undulate at margins, often falcate, or recurved, bordered, frequently serrulate. Hyaline cells frequently much reduced in upper part of leaf. Chlorophyllose cells in section triangular or trapezioid, on dorsal face, free on that face or often on both. Colour usually green or yellowish-green.

Subsect. SUBSECUNDA.

Branch-leaves variable in size, ovate-lanceolate or more frequently widely ovate and very shortly pointed, but not cucullate, bordered. Hyaline cells with small pores, frequently arranged " necklace-form " along the sides of the cells, on one or other face of the leaf. Chlorophyllose cells in section usually rectangular or trapezioid, with the longer side on either the dorsal or the ventral face of the leaf, nearly always free on both faces. Colour usually green.

Sect. II. INOPHLOEA.

Internal walls of the epidermis of stem and branches usually *with spiral fibres.* Branch-leaves *rounded and cucullate* at apex; inner walls of hyaline cells where they adjoin the chlorophyllose cells frequently papillose.

Subsect. CYMBIFOLIA.

Branch-leaves large, rounded, cymbiform, cucullate. Chlorophyll cells in section variable, free on inner or both faces or small and included on both. Colour frequently brownish, or flesh-coloured.

Section I. LITOPHLOEA.

Subsect. ACUTIFOLIA Schlieph.

1. **Sphagnum fimbriatum** Wils. in Hook. Fl. Antarct., ii, 398 (1847).

Stem leaves spathulate, without fibres, broadly rounded above and fimbriated in all the upper part. Chlorophyllose cells of branch-leaves in section trapezioid to rectangular, free on both faces.

I have not seen this from New Zealand, but Lyall's plant was identified by Wilson, and is accepted by Warnstorf, so there can be no doubt of its correctness. I do not know that it has been found by any other collector. It is a slender and delicate plant, with small, narrow leaves, and slender, graceful branches.

Subsect. RIGIDA Lindb. emend. Warnstorf.

2. **Sphagnum antarcticum** Mitt. in Journ. Linn. Soc., Bot., iv, 106 (1859).

Stem leaves much like those of *S. fimbriatum,* triangular-lingulate or oblong-lingulate, rounded and fimbriate at apex. Branch-leaves widely ovate. The most robust of the New Zealand species, with the colour and habit of the Cymbifolia Subsection, and frequently difficult to separate without microscopic examination, especially in the dry state. Careful examination of the branch-leaves in the moist state, however, will show at once that the apex is not cucullate, but truncate and toothed.

S. Campbellianum C.M. in herb. Beckett belongs here.

Warnstorf gives the following varieties:—

Var. australe (Mitt.) (*S. australe* Mitt. in Journ. Linn. Soc., Bot., iv, 106. *S. erosum* Warnst. in Hedwig. xxix, 242).

Branches crowded and often pointing upwards.

S. falcirameum C.M. in herb. Beckett belongs here.

Var. Helmsii (Warnst.) (*S. Helmsii* Warnst. in Hedwig. xxix, 244).

Resembling dense forms of *S. cymbifolium*. Stem leaves much smaller than the preceding forms, .85-1 mm. long.

Var. ericetorum (C.M.) Warnst. (*S. ericetorum* C.M. MS. *S. densicaule* Warnst. in Hedwig. xxxix, 105).

In very dense, low tufts. Stem leaves large, 1.8 mm. long and 1 mm. wide; branches very dense, branch-leaves very concave, wide, scarcely pointed.

Chatham I., Schauinsland.

Subsect. CUSPIDATA Schlieph.

KEY.

- Stem-leaves fibrose, ovate-lingulate, rounded and toothed at apex, 1.25 mm. long; border much widened below ... 3. *S. subcuspidatum*
- Stem-leaves triangular lingulate, rounded and toothed or erose at apex.
  - Stem-leaves without fibres.
    - Branch-leaves serrate above.
      - Border of stem-leaves much broader at base; branch-leaves narrowly lanceolate, sharply serrulate ...... 4. *S. elegans*
      - Border of stem-leaves little broader below; branch-leaves ovate-lanceolate, very finely serrulate 5. *S. Kirkii*
    - Branch-leaves entire.
      - Stem-leaves large, 1-1.25 mm. long, .8-.9 mm. wide .... 6. *S. linguaefolium*
  - Stem-leaves fibrose.
    - Branch-leaves serrate above .... 7. *S. irritans*
    - Branch-leaves entire .... 8. *S. Setchellii*
- Stem-leaves triangular, apex acute or truncate, not rounded.
  - Chlorophyllose cells of branch-leaves in section more or less triangular, enclosed on the ventral face .... 9. *S. lanceolatum*
  - Chlorophyllose cells more or less trapezioid, free on both faces .... 10. *S. cuspidatum*

3. **Sphagnum subcuspidatum** C.M. & Warnst. in Hedwig. xxxvi, 155 (1897).

Warnstorf records this from Lake Te Anau (Beckett). I have it also from North Auckland, coll. H. B. Matthews. It is distinguished—in the Cuspidata group—by the ovate-lingulate or broadly lingulate stem-leaves rounded at apex.

4. **Sphagnum elegans** C.M. in Flora, 1887, p. 413.

Warnstorf records this from both Islands. I have it from the South I., collected by R. Brown.

5. **Sphagnum Kirkii** Warnst. in Bot. Centralbl. lxxxii, 53 (1900).

Warnstorf records this from Auckland. I have it also from Dunedin, coll. P. Martin. The branch-leaves are slightly recurved when dry, and very little undulate.

6. **Sphagnum linguaefolium** Warnst. in Bot. Centralbl. lxxvi, 421 (1898).

Warnstorf gives no locality for this beyond New Zealand, coll. Dall.

7. **Sphagnum irritans** Warnst. in Allgem. Bot. Zeitschr., 1895, p. 173.

Syn. *S. mollissimum* Wils., *non* Mitt.
Warnstorf cites this from Chatham I. only.

8. **Sphagnum Setchellii** Warnst. in Hedwig. xlvii, 121 (1907).

Warnstorf describes and figures this as a plant with habit of *S. cuspidatum* var. *plumosum*, having long, narrow branch-leaves. It was collected by Setchell in the North I.

9. **Sphagnum lanceolatum** Warnst. in Hedwig. xxix, 219 (1890).

Described by Warnstorf as like *S. cuspidatum*, and evidently differing from it only by some slight characters.
Collected by Colenso in one locality.

10. **Sphagnum cuspidatum** Ehrh. in Pl. crypt., n. 251 (1791).

Warnstorf cites for New Zealand, besides the type—
Var. **plumulosum** Schimp. in Hist. nat. des. Sph., p. 68 (1857); f. filiforme (Hampe).
Otago, Beckett.

Subsect. SUBSECUNDA Schlieph.

11. **Sphagnum novo-zelandicum** Mitt. in Journ. Linn. Soc., Bot., iv, 99 (1859).

In habit and form of branch-leaves much like *S. antarcticum*, but totally different in the stem-leaves, oblong or obovate-lingulate, not fimbriate above, with very narrow border, and in the pores of the branch-leaves, which on the dorsal face are small, and very closely arranged "like a string of pearls" along the side of the wall of the cell.

Section II. INOPHLOEA.

Subsect. Cymbifolia Lindb.

The species of this subsection resemble one another closely in habit, and are only to be distinguished by careful microscopic examination.

Key.

- Inner walls of hyaline cells of branch-leaves papillose *S. papillosum*
- Inner walls of hyaline cells of branch-leaves smooth
  - Chlorophyllose cells of branch-leaves in section narrowly triangular or narrowly trapezioid, free (with a thickened wall) on the ventral face.
    - Woody layer of stem dark reddish-brown; plant very robust .... *S. maximum*
    - Woody layer of stem brown.
      - Stem-leaves 1-2 mm. long, .8-.9 mm. wide, often fibrose .... *S. cymbifolium*
      - Stem-leaves 1.4-1.5 mm. long, .75 mm. wide, mostly efibrose *S. microcephalum*
  - Chlorophyllose cells of branch-leaves in section spindle-shaped or barrel-shaped, free on inner face or both faces, with thickened wall.
    - Epidermal layer of stem 3-stratose, woody layer pale brown; stem-leaves 1.7-1.8 mm. long, .7 mm. wide, mostly fibrose. Branch-leaves 1.8-1.9 mm. long, 1.3 mm. wide *S. cymbophylloides*
    - Epidermal layer of stem 3-5 stratose, woody layer dark brown or dark purple. Stem-leaves 1.7 mm. long, .75-8 mm. wide , mostly efibrose. Branch-leaves 1.6-2 mm. long, 1.4 mm. wide *S. otagoënse*
    - Epidermal layer of stem 4-5 stratose; woody layer yellowish or pale brown. Stem-leaves 1.4-2.2 mm long, .9 mm. wide, efibrose or with fibres in the upper part. Branch-leaves 1.7 mm long, 1.45-1.5 mm. wide *S. subbicolor*
  - Chlorophyllose cells of branch-leaves in transverse section small, elliptic, enclosed in mid-leaf by the hyaline cells.
    - Stem epidermis multifibrose. Stem-leaves 1-2 mm. long, .7-.8 mm. wide, often fibrose above .... *S. magellanicum*
    - Stem epidermis with few fibres. Stem-leaves 1.3 mm. long, 1.14 mm. wide, usually efibrose .... *S. Dielsianum*

12. **Sphagnum papillosum** Lindb. in Act. Soc. Sc. fenn. x, 280 (1872).

Warnstorf records this as collected in New Zealand by Dall. It is to be recognized principally by the lateral walls of the hyaline cells of the branch-leaves, where they adjoin the chlorophyllose ones, being finely papillose. Otherwise it generally resembles other species of this Subsection.

13. **Sphagnum maximum** Warnst. in Hedwig. xxx, 160 (1891).
Syn. *S. australe* Schimp., *non* Mitten.

I have not seen this, which is described as resembling a robust form of *S. cymbifolium.* Warnstorf cites two New Zealand collections, by Kirk and Hochstetter, but does not specify the localities.

14. **Sphagnum cymbifolium** Ehrh. Hannov. Mag. 1780, p. 235.

The type species of the Subsection. Probably less common in New Zealand than *S. subbicolor.*

15. **Sphagnum microcephalum** C.M. in litt., e Warnst. in Hedwig. xxxix, 106 (1900).

Described as a small, compact plant, pale above, brownish below. Gathered on summit of Ben Lomond by Schauinsland.

16. **Sphagnum cymbophylloides** Warnst. in Hedwig. xlvii, 79 (1907).

This is perhaps one of the more frequent plants of this Subsection in New Zealand. It must not be confused with the Australian and Tasmanian *S. cymbifolioides* C.M.

17. **Sphagnum otagoense** Warnst. in Beih. zum Bot. Centralbl. xvi, 250 (1904).

From the description this can be only very slightly different from the last.

18. **Sphagnum subbicolor** Hampe in Flora, 1880, p. 440.
Syn. *S. centrale* Jens. in Bihang til K. Svenska Vet.-Akad. Handl. xxi, 34 (1896).

A robust species, not to be distinguished from *S. cymbifolium, S. magellanicum,* etc., except by careful sectioning of the branch-leaves, but then not hard to recognize. (This character, however, will not separate it from the two preceding species.)

It is probably one of the more common species.

S. trachynotum C.M. MS. in Helms, Neuseel. Laubm. 44, belongs here, as does also *S. trachyacron* C.M. MS. in herb. Beckett.

19. **Sphagnum magellanicum** Brid. Musc. Recent. ii, 28 (1798).
Syn. *S. medium* Limpr. in Bot. Centralbl. vii, 313 (1881).

Readily distinguished from all but the next species by careful sectioning of the chlorophyllose cells.

This species is not recorded from New Zealand by Warnstorf, but I have it from a bog, Brabourne, N-W. Nelson, Jan. 1925, coll. H. H. Allan (67), c. fr.

20. **Sphagnum Dielsianum** Warnst. in Beih. zum Bot. Centralbl. xvi, 249 (1904).

Extremely near to *S. magellanicum,* but differs in the form of the stem leaves, not much longer than broad; they are also generally efibrose.

Collected on Upper Broken River, in shady Nothofagus forest in stream, by Diels.

CORRIGENDA.

p. 9 line 11 *for D. read Dicranum*
p. 10 lines 18, 19 *for fasciatum read dicarpum*
p. 38 line 25 *for* pilaceous *read* julaceous
p. 38 line 15 from bottom *for* foleate *read* falcate
p. 46 line 11 *for* Music *read* Musci.
p. 50 middle *read* Ceratodon purpureus (L.) Brid. and var. xanthopus Sull.
p. 52 line 4 from bottom *for* indubitiably *read* indubitably
p. 53 line 10 from bottom *for* pixta-costal *read* juxta-costal
p. 55 line 7 from bottom *for* F. W. *read* T. W.
p. 60 line 15 *for* pixta-costal *read* juxta-costal
p. 67 line 7 of middle paragraph *for* exceedingly *read* exceeding
p. 68 line 20 *for pygmaea read pusilla*
p. 74 last line *for* Petrie *read* Buchanan
p. 89. A line has dropped out in the synonymy of C. appressifolius. After line 2 . . . . . nec Dicranum *add*: *clavatum* R. Br.). *Dicranum sulphureo-flavum* C.M. in Hedwig.
p. 117 line 2 from bottom *for* Duo *read* Dus.
p. 157 line 1 *add*: (Plate IX, fig. 1.)
p. 158 line 11 from bottom *for* Campylodontium *read* Campylopodium
p. 161 line 10 *for crispulum read rupestre*
p. 162 top of page insert ORTHOTRICHACEAE, and alter the page-headings "Grimmiaceae" to "Orthotrichaceae" on pp. 163-189.
p. 164 line 2 *add*: (Plate IX, fig. 3.)
p. 168 line 13 from bottom *for graphionitrium read graphiomitrium*
p. 170 line 7 *for* by Dixon, in Botan. Notes, *read* by Dusen, in Botan. Notis.
p. 170 line 17 *for graphiometrium read graphiomitrium*
p. 171 line 15 from bottom *for* berbarium *read* herbarium
p. 174 mid-page *for* xigzag *read* zigzag
p. 175 line 9 from bottom *for lateciliatum read laticiliatum*
p. 178 last line *for* Schleich *read* Schleich.
p. 181 line 3 *for* earler *read* earlier.
p. 182 line 16 from bottom *for* ofter *read* often
p. 183 line 6 *for* ex. *read* ex
p. 189 line 13 *delete* the bracket after "account"
p. 189 line 6 from bottom *for* Hook *read* Hook.
p. 190 mid-page and line 12 from bottom *for purpurens read purpureus*
p. 192 mid-page, *after* Physcomitridium Readeri (C.M.) Roth . . . . *add*: (Plate IX, fig. 7).
p. 194 line 9 *for* Broth *read* Broth.
p. 194 mid-page *after* Funaria Subattenuata Broth. *add*: (Plate IX, fig. 14).
p. 194 line 15 from bottom *for* sit. *read* cit. *And add*: (Plate IX, fig. 17).
p. 194 line 5 from bottom *for* no specimen *read* no authentic specimen
p. 195 mid-page *after* Funaria cuspidata H. f. & W. . . . *add*: (Plate IX, fig. 15). And *after* Funaria glabra Tayl. *add*: (Plate IX, fig. 16).
p. 196 line 4 from bottom *add*: (Plate IX, fig. 20).
p. 197 *after* Mielichhoferia Eckloni Hornsch . . . . *add*: (Plate IX, fig. 18). And *after* M. australis Hampe . . . . *add*: (Plate IX, fig. 19).
p. 197 line 6 from bottom *for* Suppl. *read* Suppl. II,
p. 204 under 3. Caespitibryum, line 1, *for* tuft *read* tufts
p. 206 line 4 from bottom *for* ter *read* ter.
p. 209 line 1 *for* Doliolodium *read* Doliolidium
p. 210 line 10 *for* from *read* for
p. 216 line 12 from bottom *for* sterile *read* usually sterile
p. 222 line 18 *after* figured *add* under
p. 223 line 9 *for* spinoforme *read* spiniforme
p. 223 line 4 from bottom *for* is *read* are
p. 228 line 11 from bottom *add*: (Plate IX, fig. 21)
p. 229 line 2 *add*: (Plate IX, fig. 22)
p. 232 line 9 *add*: (Plate IX, fig. 23)
And *after* B. Sieberi *add*: (Plate IX, fig. 24)
p. 234 line 1 *for* Catharineaea *read* Catharinaea
p. 234 line 15 from bottom *for* Botherus *read* Brotherus
p. 238 line 7 *for calvescens read calvum*
p. 242 after Cryphaeaceae insert Cryphaea Mohr
p. 261 line five from bottom *for* soedide *read* sordide
p. 272 line 20 from bottom *for* Becketii *read* Beckettii

ADDENDA.

p. 20. After **Dicranoloma chrysodrepaneum** (C.M.).

Dicranoloma integrifolium Dixon sp. nov. (Plate X, fig. 14.).

D. chrysodrepaneo (C.M.) forsan affine, sed brevius, foliorum subulis *multo brevioribus*; *caules* 3-4 cm. alti, fuscescentes, *turgidi, apicibus cuspidatis*.

Ab omnibus fere speciebus Novae Zealandiae differt foliis *integris* vel apice tantum minute obscure subdenticulatis; costa sat valida dorso *laevi* vel sublaevi. Cellulae omnes *minusculae*, superiores praecipue *breves*, irregulariter ellipticae vel rhomboideae, sat incrassatae.

Hab.—South I., coll. R. Brown ter.

Found in Brown's herbarium with *Bartramia papillata*, but with no further data. It appears a quite distinct species, as with the practically entire leaf apex and smooth nerve it combines a much stouter nerve than *D. Billardieri* or its group, and also a much shorter and wider leaf subula than in most of the allied species. There is at times a very narrow and ill-defined hyaline border to the leaf-base. The upper cells are much shorter than is usual in the robustum group, and the basal cells smaller, but these characters occur in *D. chrysodrepaneum*, and at times in other species of this group. The alar cells are very numerous, and smaller than in most of the species.

p. 42. **Ditrichum strictum** Hampe.

I have received this from Mitten's herbarium as "*Lophiodon strictus* (Trichostomum australe Mitt.); Great Barrier (I.), New Zealand, Hutton & Kirk, 75."

p. 43. **Ditrichum punctulatum** Mitt.

A vegetative character by which this may usually be separated from *D. elongatum* lies in the leaf subula, which here is exceedingly fine and capillary, often very glossy, and nearly always more or less spirally twisted round its own axis when dry, frequently very conspicuously. In *D. elongatum* it may be equally long and fine, but is scarcely glossy, and rarely if ever distinctly spirally twisted.

p. 51. **Cheilothela** Lindb.

As I have shown in Journ. of Bot. 1924, p. 231, the New Zealand species is identical with the Chile plant described by Montagne as *Trichostomum chilense*, and must be known as *Cheilothela chilensis* (Mont.) Broth.

Reimers, however, it should be noted considers the plants of the southern hemisphere to be distinct generically from the European *Cheilothela chloropus*, and (in Hedwig. lxvi (1925), p. 51) places them under the Pottiaceous genus Chrysoblastella R. S. Williams. If this course is followed the N.Z. plant must be known as *Chrysoblastella chilensis* (Mont.) Reimers.

pp. 52-54. **Pseudodistichium.**

Among a collection of mosses made in 1874-75 by S. Berggren (now in the Museum of the University of Lund) I found specimens of both the New Zealand species of this genus, and in a condition to throw fresh light on the peristome characters.

In *P. Buchanani* the teeth are erect, strict and linear-subulate, not broadened at base, 180μ long, densely and highly but finely papillose, entire with a longitudinal line or more distinctly cleft, but with the two halves closely united throughout their length. Spores 9-12 μ. Annulus distinct, revolute. (Rotorua, North I., 1875; S. Berggren, No. 2415.) These characters separate the species at once from *P. austro-georgicum* Card.

In Berggren's specimens of *P. Brotherusii* (Kelly's Hill, South I., 1874, No. 2426; and Porter's Pass, South I., 1874, No. 2425), the peristome is somewhat worn, but it shows the teeth deep orange red, pale at apex, short and wide, irregularly divided to base with the halves closely approximated, neither striolate nor papillose, but opaque and obscure with irregular markings. In the peristome characters, therefore, it approaches more nearly to *P. austro-georgicum*, but differs in the teeth not being striolate, as well as in the short, turgid capsule.

p. 69. After **Dicranella cyrtodonta** (C.M.)

Dicranella egmontensis Dixon sp. nov.

§Dicranella. *Perhumilis*, subnitida; caules perbreves, ramosi, folia *falcato-secunda*, inferiora e basi lata *sensim* in acumen filiforme integrum (raro apice dentibus paucis inconspicuis praeditum) angustata. Costa *tenuis*, male delimitata. Folia superiora et perichaetialia e basi latiore, vaginante, sat raptim in acumen longius, sericeum contracta. Cellulae partis basilaris superiores anguste lineares, pellucidae, parietibus tenuibus, basilares laxiores; eae subulae breviores, irregulares, breviter lineares, et anguste rhomboideae, parietibus firmioribus; *omnes nisi basilares infimae perangustae*.

Inflorescentia autoica. Flos ♂ terminalis ad ramulos. Seta *brevissima*, vix .5 cm. alta (immatura) flavida. Theca *minuta*, deoperculata 1 mm. longa, *erecta*, *symmetrica*, operculo subaequilongo, subulato, obliquo; exothecii cellulae irregulares, *elongatae*, *parietibus curvatis*. Peristomium *parvum*, vix .25 mm. longum; dentes ad basin rubram conjunctae; pars basilaris *perbrevis*, annulum revolubilem latum vix superans inde in crura 2-3 inaequalia pallida erecta divisae, ubique recte et oblique striolatae inferne *tenerrime inconspicue* lamellatae. Spori minuti, laeves.

Hab.—Mt. Egmont, Jan. 1926; G. O. K. Sainsbury (No. 353).

A very distinct little species, with no near allies at least in the Australasian region. Only a single capsule was found, so that the above description of the peristome may need some slight modification, but there is every reason to suppose it normal.

D. gracillima is entirely different in the very short leaves, wider cells, red seta, and much more solid and robust peristome, the basal part constituting the greater part of the teeth, and with the crura strongly and closely trabeculate.

p. 91. **Campylopus nudus** (Hampe).

Further examination of Hampe's specimens at the British Museum shows that this is certainly not a Campylopus, but *Dicranoloma Menziesii* (H. f. & W.).

p. 100. After **Fissidens dealbatus** H. f. & W.

Fissidens hylogenes Dixon sp. nov. (Plate X, fig. 16). **Polypodiopsis.**

Pertenellus; corticola; planta tota vix .5 cm. alta, *saturate viridis*. Folia *paucijuga* (3-6 juga), plerumque laxa, *praemollia*, tenerrima, perpellucida, spathulato-oblonga, *obtusa vel subobtusa, elimbata, sed cellulis marginalibus serie unica* (*raro duplo*) *perminutis, crenulatis*; cellulae superiores internae subhexagonae, irregulares, saepe 30 μ × 20 μ, margines versus minores, circa 20 μ × 12 μ, marginales ipsae circa 8 μ × 5 μ, subrhomboidae, omnes parietibus pertenuibus; basilares laxiores, rectangulares; costa nulla.

Flos ♂ haud visus. Seta terminalis, *brevis*, 1.5-2 mm. longa, tenius, pallida. Theca erecta, minuta, .4-.5 mm. longa, ovata, leptodermica, operculo rostellato, recto. Peristomium *tenellum*; dentes ad basin rubri, dense lamellati, lamellis ipsis papillosis; crura aurantiaca, filiformia, superne pallida, per totam longitudinem spiraliter nodosa.

Hab.—On damp wood in shade, Marumaru Caves, Hawkes Bay, Nov. 1924, G. O. K. Sainsbury (No. 155).

A delicate, pretty little species, totally distinct from the only other New Zealand species of the Subgenus, *F. dealbatus*, which is a much more robust plant with very acute, quite entire clearly bordered leaves.

The nearest species is *F. usambaricus* Broth. from tropical Africa, which has a similar pseudo-border of minute cells, but in that case the margin is entire, not crenulate.

I have given it a name (wood-dweller) expressive of its predilection for deep shady woods.

p. 103. After **Fissidens vittatus** H. f. & W.

Fissidens subelamellosus Dixon sp. nov. (Plate X, fig. 15.).

Semilimbidium. *F. elamelloso* Hampe & C.M. affinis; multo elatior, seta praecipue multo longiore, theca cernua, foliis longioribus angustioribus differt.

Hab.—On papa in shady watercourse, Kiwi, Turiroa, near Wairoa; E. A. Hodgson, Aug. 1926 (136). Wairoa, G. O. K. Sainsbury, Sept. 1923 (No. 10).

p. 121. **Leptodontium interruptum** (Mitt.).

The fruit of this, hitherto unrecorded, was found by Mr. Sainsbury in T. F. Cheeseman's herbarium, labelled "Woodhill, Oct. 1882." The setae are about 1 cm. long, and flexuose. Capsule erect, smooth, narrowly elliptic, 1.5 mm. long; lid subulate, erect, 1 mm. long. Peristome teeth erect, orange, short, about equalling half the diameter of orifice, smooth, nodose, irregularly cohering above in twos and threes, and more or less united at base.

This rare species was moreover collected by Mr. Sainsbury on sandy soil near the sea at Whakaki, Wairoa Co., Hawkes Bay, in Feb. 1927.

p. 164. **Zygodon anomalus** Doz. & Molk.

According to Malta (Die Gattung Zygodon Hook. & Tayl., p. 125) the correct name for this is *Z. Hookeri* Hampe in Linn. xxx, p. 632 (1859-60). He also shows (p. 118) that *Z. anomalus* Doz. & Molk. was founded on a mixture of two species, and must disappear from synonymy.

p. 165. **Zygodon Menziesii** (Schwaegr.).

Add: var. **angustifolius** Malta in Acta Univers. Latv. x, 317 (1924), et Die Gattung Zygodon, p. 154, fig. 94.

Malta at first considered this to be a new species, but finally decided that it was a race of *Z. Menziesii*, distinguished by its narrower leaves, lingulate and subobtuse with a minute apiculus, incurved and almost cucullate at apex. It is only known from New Zealand, where it was collected by W. Gray both on willows and on limestone rocks near Mauriceville, Wairarapa (Nos. 9, 47, 50). I have it also from Half Moon Bay, Stewart I., rocks at high-water mark, Jan. 1889, Herb. Mitten (679), sub nomine *Z. obtusifolius* Hook.

p. 167. **Zygodon subminutus** Broth.

Malta (op. cit., p. 160) has identified this New Zealand plant with a Javan species (also found in Bolivia) published by Fleischer as *Z. gracillimus* Broth. MS., in Musci . . . . von Buitenz. ii, 392 (1902-04). The name *Z. subminutus* must therefore be dropped.

p. 171. **Orthotrichum angustifolium** H. f. & W., and **O. crassifolium** H. f. & W. have been separated off from Orthotrichum by Dusen (in Botan. Notis. 1905, p. 304) as a distinct genus, Muelleriella, based principally on the bi-stratose leaves, the absence of inner peristome, and very large spores.

p. 180. Under **Ulota** Mohr.

Since the publication of Part IV I have detected the presence of another species of Ulota in New Zealand, and the following addition should be made on p. 180.

KEY.

Leaves strongly crisped when dry	1. *lutea*
Leaves small, very narrow, slightly contorted when dry	2. *anceps*

2. **Ulota anceps** Vent. in Oefv. af Finska Vet.-Soc. Foerh. xxxv, 42 (1893).

A smaller and more delicate plant than *U. lutea*, with leaves 1.5-2 mm. long as against 2-3 mm., with a much more acute and narrow subula, which is indeed sometimes almost subulate; and especially distinct in the leaves only moderately twisted when dry, not strongly crisped and incurved. The leaf base is also more distinct, being obovate or almost orbicular, whereas in *U. lutea* it is usually much less narrowed to the line of insertion, and frequently more gradually contracted above. The nerve also is much weaker, 25-32 μ wide at base, as against 35-40 μ in *U. lutea.* I do not find any marked difference in the areolation, except that the cells in *U. anceps* are probably slightly more incrassate, and therefore appear more distant, and more irregular in form, being often distinctly elongate.

The fruit is slightly more delicate, but otherwise appears to offer no structural characters.

This Tasmanian species was gathered by Mr. W. Bell in Jan. 1890, and was determined by Mitten as *U. appressa* Mitt. MS. Mitten's name, however, was never published. The two specimens of it in my herbarium are labelled, one, "Kinloch, on stems and branches, W. Bell, Jan. 1890," ex herb. Brotherus; the other "Mt. Bonpland, Otago, W. Bell, Jan. 1890," ex herb. Naylor Beckett.

I have examined a specimen of *U. cochleata* Vent., and cannot detect any difference from *U. anceps*; nor is there any difference suggested by the descriptions with the exception of the peristome, the teeth of *U. cochleata* being described as longly acuminate, with the tips filiform and anastomosing; those of *U. anceps* as obtuse, and not anastomosing at tips. My specimen of *U. cochleata* (Mt. Wellington range, W. A. Weymouth, 1524), however, shows the teeth exactly as described for *U. anceps,* and I do not think the difference is more than one of a more or less full maturity in the peristome, such as one finds occasionally in Orthotrichum. As the above specimen, however, was not authenticated by Venturi, I do not feel justified at present in reducing *U. anceps* to the synonymy of *U. cochleata.*

p. 183. **Macromitrium Weymouthii** Broth.

Fleischer, Musci . . . von Buitenzorg, ii, 434, cites Fl. N.Z. ii, 78, for *M. recurvifolium* (Hook. & Grev.) Brid. The New Zealand plant, however, there described is not identical with Hooker & Greville's species, but is *M. Weymouthii.*

p. 184. **Macromitrium gracile** (Hook.).

Add: nov. var. **proboscideum** Dixon. Folia, praecipue superiora, in proboscidem praelongam subulatam vel loriformem, saepe crassam, siccitate rigide deflexam, vetustate diffractam prolongata.

Hab.—On tree, L. Waikaremoana, Hawkes Bay, G. O. K. Sainsbury, Jan. 1924, No. 48 (Type). Ibidem, Jan. 1926, No. 313. On tree, Kaiparoro, Mauriceville, Wairarapa, W. Gray, No. 284; on log in orchard, Mauriceville, W. Gray, No. 271. Great Barrier I., May, 1922, W. Gray, No. 14, c. fr.

A very remarkable form, showing most markedly when the plant is dry. In that condition the lower leaves of the branches are nearly all broken off at the points, and are incurved, so that the branch is more or less terete, the points of the leaves (where not broken off) being incurved as in *M. gracile* type; in the upper leaves the long points are rigidly deflexed and slightly torquate, giving a very distinct and striking effect under the lens. The fruit does not differ from that of *M. gracile.*

The relationship between this variety and *M. retusum* is rather perplexing. In *M. retusum* the arrangement of the leaves on the branches in the dry state is very similar to that of *M. gracile*, the leaves being very regularly spirally arranged (owing to their setting on the branch) and with their points strongly incurved, so that the elongate, straight branches have a very characteristic terete or catenulate appearance, from top to bottom; and so far they are identical with those of *M. gracile*. In *M. retusum* the nerve of the leaf is excurrent from the wide, obtuse, often retuse apex in a long, green, slender, very fragile arista, which is broken off in all but the extreme apical leaves, so that these aristae form a very peculiar, delicate, penicillate, *erect*, green tuft at the tip of the branch.

In the new variety described above of *M. gracile*, the leaf apex is not broad or retuse, but is either very abruptly or more gradually narrowed into a long, linear or loriform point, consisting mainly of the nerve, but much stouter and less fragile than that of *M. retusum*, and often forming a prolongation equal to half or more of the rest of the leaf. This prolongation is usually broken off in all the lower leaves, but remains on a considerable number of the upper ones, and when dry is not erect, but rigidly deflexed, with a slight tendency to twist round the stem in a spiral direction, and this gives a very distinct appearance to the apex of the branch in the dry state, quite distinct from that of *M. retusum.*

So far the matter is simple, but in one or two specimens I have in my herbarium (e.g., in one collected by Mr. Sainsbury near L. Waikaremoana, Hawkes Bay, No. 313) the branches show both the erect penicillate aristae characteristic of *M. retusum*, and the reflexed prolongations of the present variety, while the leaf apex is somewhat intermediate in form.

The type of *M. appendiculatum* C.M. shows a very similar condition; and I have found the same thing, though less strongly marked, on other specimens.

The question arises, therefore, whether *M. retusum* be really specifically distinct from *M. gracile*. Besides the characters above referred to, I do not know any that separate it, though I have thought that the upper cells in *M. retusum* were somewhat more obscure than in *M. gracile*. The fruit of *M. retusum* has not been found. The plants referred to require a careful study in the field.

p. 192. **Physcomitridium Readeri** (C.M.).

This has been collected by E. A. Hodgson, "sides of a field drain, Kiwi, Wairoa Co. Hawkes Bay, Dec. 1926," and sent me by Mr. Sainsbury. It agrees quite well with R. Brown's specimen described on the above page. The capsules constantly break up irregularly along a median zone, though the lid is clearly differentiated.

p. 201. **Pohlia tasmanica** (Broth.).

Mr. Sainsbury gathered this in fruit on damp earth, Ohuka Gorge, Wairoa Co., in Oct. 1925. The fruit has not been described (except as *Bryum Binnsii* R. Br. ter.). The seta is red, slender and flexuose, about 1 cm. long, cygneous below the capsule; capsule small, turgidly oval, without any distinct neck, red; lid conical, very shortly mamillate. Peristome rather large, orange red; the teeth broad, tapering to a not very fine point, very finely papillate on the dorsal surface, densely lamellate, the lamellae stout and prominent within; endostome pale, membrane high, quite equalling half the length of the teeth; processes nearly equalling the teeth, variously cleft and rimose. Cilia filiform, slightly nodose, about as long as the processes. Spores 18-22 μ.

p. 203. **Anomobryum Harriottii** (R. Br. ter.).

Mr. Sainsbury has collected good specimens of this in two or three localities in Hawkes Bay, notably a fine fruiting specimen from wet bank of river, Mangapoike Valley. The plants are in all respects much larger than in the original specimens of R. Brown's or in my *Anomobryum densum*; the capsules are larger; the neck longer and more distinct, the peristome larger and the vegetative characters better developed, so that the true affinity for some time escaped me, and I had indeed drawn up a description of it as a new species of Bryum. Structurally, however, it agrees entirely with the above plants, and indicates that they both represent poorly developed forms of the species.

My description of *A. densum* in Bull. Torr. Bot. Club 42: 103 will fit the plant exactly if the following dimensions replace those given there: stems 2 cm. high; leaves 1 mm. long; seta 1.5 cm.; peristome teeth .5 mm. The inner peristome usually shows a small number of comparatively conspicuous papillae, scattered sparsely over the processes.

p. 210. **Bryum chrysoneuron** C.M.

Sterile slender plants of *B. obconicum* may at times be so like this species as to be scarcely separable. The capsule, however, is much smaller in *B. chrysoneuron*, and of a deep reddish colour, that of *B. obconicum* being of a reddish-brown.

p. 214. **Bryum Billardieri** Schwaegr.

Although as stated here the leaves are not as a rule rosulate and comose, forms occur with the other characters of the species which show the leaves decidedly comose; and too much reliance must not be placed on this character.

p. 223. **Rhizogonium** (**Spiridentella**) **Helmsii** C.M. in Hedwig. xxxvi, 333 (1897) is only *Cryptopodium bartramioides* (Hook.), the ♂ plant. I have a specimen of Helms's collecting, Paparoa Range, S. Island, July 1888, ex herb. I. Cosmo Melvill, *sub nomine* Rhizogonium (Spiridentella) Helmsii C. Muell.

p. 227. **Bartramia robusta** H. f. & W.

Mr. Sainsbury has sent me a specimen so determined by Brotherus, collected probably in the Auckland Is. by J. T. Tennant, on the N.Z. Institute Expedition, 1907. This has the capsules erect and symmetrical and quite gymnostomous, and supports the specific status of *B. robusta*.

p. 233. Before **Polytrichaceae** insert—

BUXBAUMIACEAE.

Buxbaumia Hall.

Buxbaumia novae-zelandiae Dixon sp. nov. (Plate X, fig. 13).

A *B. tasmanica* Mitt. differt seta longiore, multo tenuiore, omnino laevi.

Hab.—On loose rock on hillside, Upper Atiamuri, near Rotorua; coll. K. W. Allison, Aug. 1927.

The discovery of a representative of this remarkable genus in New Zealand is one of the most interesting recent additions to the moss flora of the Island. Hitherto the genus has been restricted to the two well-known northern *B. aphylla* and *B. indusiata*, with three other rare northern species, one in the U.S.A., one in Japan, and one in Java, with a single representative in the southern hemisphere, viz., the Tasmanian *B. tasmanica Mitt.* The New Zealand plant might be expected to be identical with the Tasmanian one, and I was at first inclined to refer it there. Most unfortunately Mitten's species is only represented by three specimens, two at Kew, and one in Mitten's herbarium, and these have the capsules unripe and the peristome, therefore, as well as the structure of the exothecium, uncertain. Careful examination of the specimens, however, reveals what appear to be constant, if slight differences from the New Zealand plant. (Mrs. Britton has kindly sent me drawings and measurements of the specimen in the New York Herbarium.) *B. tasmanica* has the setae 4, 6, and 8 mm. in length respectively, comparatively stout, viz., .4 mm. in thickness; they all appear smooth, though Mitten describes the plant as "pedunculo subscabro," and figures a seta as decidedly papillose at apex. Only imperfect peristome was seen.

The two setae of the new species that I possess are respectively 1.6 and 1.8 cm. long, and only .2 mm. in thickness, and are quite smooth, and these differences alone, I think, would preclude its being referred to *B. tasmanica.* Further specimens have I believe been collected, and it will be interesting to ascertain how far the above characters prove to be reliable.

p. 237. **Polytrichum commune** L.

Most of the New Zealand plants belong to a southern form having the nerve of the leaf excurrent in a rather marked, serrate, pale arista, which in the perichaetial leaves may be conspicuously prolonged and subhyaline. This form was published by Rehmann in his S. African Mosses as *P. trichodes*, which I reduced to a variety in S. Afr. Journ. of Sci. xviii, 323, as *P. commune* var. *trichodes* (Rehm.) Dixon.

p. 249. **Echinodium umbrosum** (Mitt.).

Mr. Sainsbury writes later that this seems quite plentiful in the Wairoa district, always on damp papa rocks or stones in shady bush.

p. 194. After **Funaria subcuspidata** Broth.

Funaria producta (Mitt.) Broth. in Engl. & Prantl, Pflanzenfam., Musci, i, 522 (1903).

Syn. *Entosthodon productus* Mitt. in Journ. Linn. Soc., Bot., iv, 80 (1859).

This species, hitherto confined to Tasmania, was detected in Cheeseman's herbarium, under *F. cuspidata*, by Mr. Sainsbury; it was collected by Henderson in Waitemata Co., Auckland.

It has the small, erect, symmetric capsule of *F. gracilis* and *F. cuspidata*, but a much shorter seta, less than 5 mm.; and the peristome is quite wanting. The most noticeable character, however, is in the leaves, which are very narrow, much narrower than in any of the other species, from a slightly ovate base narrowly lanceolate, finely pointed, entire, with the nerve ceasing below the apex.

p. 249. **Echinodium hispidum** var. **glauco-viride**.

This was collected in Oct., 1927, by E. M. Grant at Owenga, Chatham Is., agreeing exactly with the Fiji plant.

p. 251. **Glyptothecium**.

The proper spelling of this should be Glyphothecium, as Hampe published it. The spelling Glyptothecium arose from the copying, by Brotherus, of a printer's error in a footnote of Hampe's.

p. 290. **Pterygophyllum distichophylloides** Broth. & Dix.

The fruit of this was collected, for the first time, by Mr. Sainsbury in Sept. 1927. The perichaetial bracts are acute. The seta is short, 5-6 mm., smooth, and very thin; the capsule very small, horizontal, dark purple-brown, with a distinct swollen ring at the neck, and a very long, reddish lid, quite equalling the capsule in length.

p. 329. After RHYNCHOSTEGIUM.

RHYNCHOSTEGIELLA Limpr. Laubm., iii, 207 (1896).

Rhynchostegiella novae-zealandiae Dixon sp. nov.

Pertenella, habitu *Amblystegii serpentis*; pallide viridis. Caulis repens, irregulariter, vage ramosus, ramis *flexuosis*, *elongatis*, *laxifoliis*, tenuissimis. Folia minima, .5-.75 mm. longa, patentia, sicca contracta, subconvoluta, *ovato-lanceolata*, *acuminata*, acumine substricto, acuto; marginibus planis, *e basi fere ad apicem teneriter denticulatis*. Costa ad medium folium attingens. Cellulae superiores rhomboideo-lineares, breves, leniter sigmoideae, *laevissimae*; in acumine breviores, paullo latiores, omnes saepius *subopacae*, basin versus parum laxiores, alares *optime notatae*, sat numerosae, *subquadratae*, *latiusculae*, plus minusve *inanes*. Folia ramea minora, similia.

? Synoica, vel autoica. Flores in caulibus et ramis numerosi. Perichaetia parva, foliis erectis, nonnunquam leniter secundis, breviter acuminatis, subintegris. Seta *circa 1 mm. longa, leniter sed distincte papillosa*. Theca unica deoperculata visa minima, *suberecta*, asymmetrica, turgide *ovata*; exothecii rete laxum, parietibus tenuibus.

Hab. Marlborough, coll. J. H. McMahon, 1928.

An exceedingly delicate little plant, and a fully characteristic Rhynchostegiella. *R. campylioides* Broth. & Watts, from Lord Howe I., has the leaves more widely spreading, and the cells prominent on the back of leaf. The Australian *R. cucullata* (Mitt.) Dixon, has the branch leaves obtuse or subobtuse, and the cells very opaque.

I have not been able to determine the inflorescence satisfactorily. The fertile stem has very numerous flowers in all stages of development, some of which contain archegonia, and I believe quite young antheridia, but they are immature, and I did not care to dissect the only two fruiting perichaetia received. The inflorescence in the genus is nearly always autoicous.

LIST OF NEW SPECIES AND VARIETIES.

It will be convenient for purposes of references to give a list of new species and varieties published for the first time in this work.

p. 15—Dicranoloma platycaulon (C.M.) Dixon.
p. 18—Dicranoloma grossialare (C.M.) Dixon.
p. 19—Dicranoloma chrysodrepaneum (C.M.) Dixon.
p. 21—Dicranoloma cylindropyxis (C.M.) Dixon.
p. 22—Dicranolomo plurisetum (C.M.) Dixon.
p. 362—Dicranoloma integrifolium Dixon.
p. 37—Pleuridium longirostre Dixon.
p. 65—Dicranella wairarapensis Dixon. *Is D. cardotii* (R. Br. ter.) Dixon.
p. 363—Dicranella egmontensis Dixon.
p 90—Campylopus arboricola Card. & Dixon.
p. 364—Fissidens hylogenes Dixon.
p. 100—Fissidens inclinabilis C.M.
p. 101—Fissidens leptocladus nov. var. Cheesmanii (C.M.) Dixon.
p. 102—Fissidens gonioneurus C.M. subsp. nov.
p. 364—Fissidens subelamellosus Dixon.
p. 112—Weisia viridula nov. var. gymnostoma Dixon.
p. 116—Gymnostomum calcareum nov. var. longifolium Dixon.
p. 146—Tortula serrata Dixon.
p. 150—Tortula abruptinervis Dixon.
p. 162—Anoectangium Bellii Broth.
p. 167—Zygodon subminutus Broth. *Is* Z. gracillimus Broth.
p. 173—Orthotrichum calvum nov. var. brevisetum Dixon.
p. 366—Macromitrium gracile nov. var. proboscideum Dixon.
p. 369—Buxbaumia novae-zelandiae Dixon.
p. 245—Cryphaea confusa Dixon.
p. 261—Papillaria nitidiuscula Broth.
p. 266—Neckera Brownii Dixon.
p. 286—Eriopus Brownii Dixon.
p. 295—Hypopterygium novae-seelandiae nov. var. nudicaule Dixon.
p. 329—Rhynchostegium fragilicuspis Dixon.
p. 337—Stereodon maculosus Dixon.
p. 370—Rhynchostegiella novae-zealandiae Dixon.

DATES OF PUBLICATION.

Part I, pp. 1-30, Plates I-IV, *was issued* 30th June, 1913.
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Part III, pp. 75-152, Plates VII-VIII, *was issued* 1st August, 1923.
Part IV, pp. 153-238, Plate IX, *was issued* 30th June, 1926.
Part V, pp. 239-298, *was issued* 7th July, 1927.
Part VI, pp. 299-372, Plate X, *was issued* 17th January, 1929.

EXPLANATION OF PLATE X.

FIG. 1.—*Cryphaea confusa* (Type). *a*, leaf, × 20; *b*, leaf apex, × 40.

FIG. 2.—*C. chlorophyllosa* (Coll. R. Brown ter.). *a*, leaf, × 20; *b*, leaf apex, × 40; *c*, apex of perichaetial leaf, × 40.

FIG 3.—*Echinodium umbrosum*. *a*, leaf, × 20.

FIG. 4.—*E. hispidum*. *a*, leaf, × 20.

FIG. 5.—*E. hispidum* var. *glauco-viride*. *a*, leaf, × 20.

FIG. 6.—*Papillaria nitidiuscula* (Type, coll. W. W. Watts). *a*, stem leaf, × 20; *b*, branch leaf, × 20; *c*, cells of branch leaf, partly in profile, × 200.

FIG. 7.—*P. flavo-limbata*. *a*, tip of branch, × 3; *b*, leaf apices, × 20.

FIG. 8.—*Meteorium nitens* (Type, coll. Sinclair, Hb. Wils.). *a*, stem, × 1; *b*, leaf, × 20.

FIG. 9.—*Neckera laevigata*. *a*, leaf, × 20; *b*, perichaetium, × 2.

FIG. 10.—*Neckera Brownii* (Type, coll. R. Brown ter.). *a*, leaf, × 20; *b*, perichaetium, × 2; *c*, leaf apices, × 30.

FIG. 11.—*Eriopus Brownii* (Type, coll. R. Brown ter.) *a*, *a*, leaves, × 20; *b*, upper marginal cells, × 200.

FIG 12.—*Taxithelium polystictum* (Mt. Egmont, coll. W. Gray). *a*, *stem*, × 1; *b*, stem leaf, × 20; *c*, branch leaf, × 20; *d*, cells, × 200.

FIG. 13.—*Buxbaumia novae-zelandiae* (Type). *a*, plant, × 1.

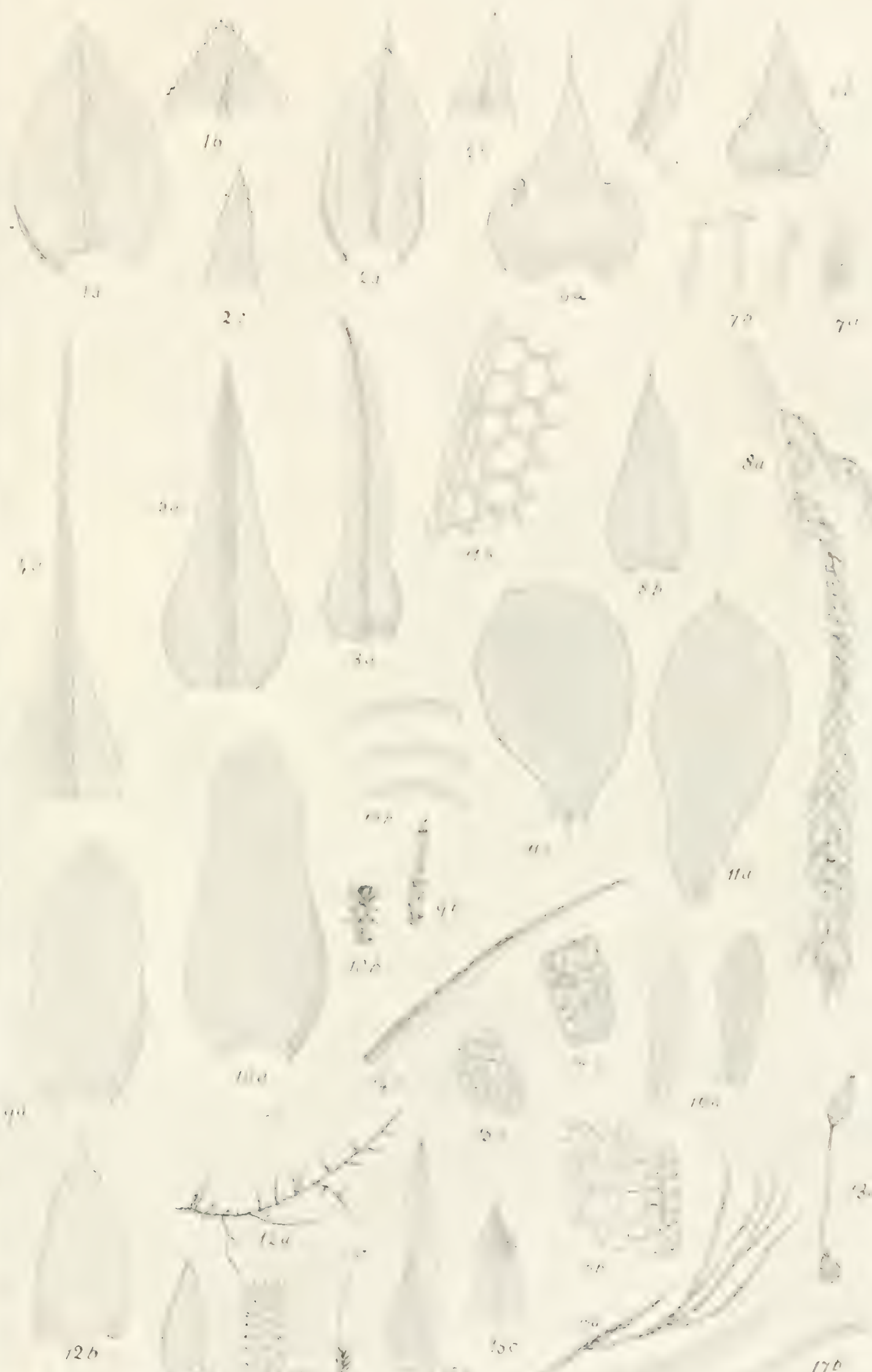
FIG. 14.—*Dicranoloma integrifolium* (Type, coll. R. Brown ter.). *a*, leaf apex, × 20; *b*, upper cells, × 200.

FIG. 15.—*Fissidens subelamellosus* (Type). *a*, plant, × 1; *b*, leaf, × 20; *c*, apex of leaf, × 40, *d*, upper cells, × 200.

FIG. 16.—*Fissidens hylogenes* (Type.) *a*, leaves, × 20; *b*, upper marginal cells, × 200.

FIG. 17.—*Drepanocladus fontinaliopsis* (Tarawera, coll. Berggren). *a*, part of stem, × 1; *b*, parts of branches, × 3.

PLATE X.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